

Smart Roadways Ticketing System (SRTS) using RFID tags

S. Sridhar Raj, S. Vijay Goku



Abstract: To provide a comfort, tension free, straightforward approach of traveling and conjointly to scale back the man power. SRTS involves the effective usage of RFID tags and Reed sensor to make ticketing better, through which the tag holds the identity of the card holder and Reed sensor, comprising a sensor and magnet to determine the distance travelled by the user. RFID Tag can be used by the user for just entering and leaving the bus. Depending on the distance which is travelled by the user, money will be deducted from the card well in advance. An object counter is placed adjacently to detect the number of persons entering the transport vehicle.

Keywords: RFID, Arduino Microcontroller, Reed Sensor, RFID tags, RFID Reader/writer, Object Counter.

I. INTRODUCTION

In the general way, every transport carrier is governed by a conductor for ticketing purpose. The ticket collector will collect currency from every traveler and issue ticket. At first, printed papers or tokens are utilized as tickets. These days, handheld machines are utilized to print tickets. This framework has numerous drawbacks. The traveler need to convey the ticket till the finish of movement, the conductor ought to guarantee that everybody has the ticket, the time taken for ticketing is relatively more and colossal measure of paper is expected to print the Ticket, which in turn leads to the devastation of lot of trees for making up papers for this purpose. Nowadays the ticket collectors are trained to handle the hand-held ticketing machine. For instance, if a traveler would like to travel in bus. He needs to carry cash with him. Then conductor can collect the cash and he can offer price ticket. This needs to repeat for all passengers. This can take longer and waste of human Resource further as energy. Even hand-held ticketing machine is relatively slow and want trained person to work it.

II. PROPOSED WORK

This work deals with enforced exploitation of RFID technology, Arduino microcontroller and Reed sensors, which may determine the count of passengers boarded to public transport furthermore all accounting purpose associated with travel expenses.

Automated accounting of fare would give helpful estimates for the travel expenses from one point to another. The traveler from public should carry RFID travel card along with. As shortly as they step into the bus they are supposed to specify the RFID card to the reader/writer [1]. The accepted data are to be hold on within the microcontroller, which is connected to the RFID reader/writer. As soon as the person has reached his destined location/stop again, he has got to reveal his RFID card to the reader, over which the extensive fare would be deducted accordingly using Reed sensor which calculates the distance based on number of rotations of the wheel and the circumference of the wheel and the balance amount is written into the card [2].

III. SYSTEM DESCRIPTION

Our proposed work is Comprises of five main modules:-

- RFID tags
- RFID Reader/writer
- Microcontroller
- Reed Sensor
- Object Counter

Radio frequency identification system comprises of tag and reader which utilises the EM field for data transfer/sharing. It completely involves with digital encoding as like that of bar codes except, which does not require the components to be straight line aligned for capturing [3]. The set of protocols instructions or software is used to fulfil the connecting gap between tag and applications. It can be modified based on the specifications and application that has been deployed. The However it has its restrictions in reading range. This type of problems is escorted but improving the reader antenna gain by whose signal cannot be detuned or distorted. Arduino Mega 2560 is a microcontroller board centered the ATmega2560 [4] which has fifty four digital input/output pins (out of that fifteen are used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial port), 16 megacycle per second quartz oscillator, a USB association , supply jack, associate degree ICSP header and a power button. It contains everything required to support the microcontroller; merely connect it to the pc with a USB cable or power it with a battery or adapter to begin it. The Reed Sensor is an electronic switch operated on the applied magnetic field. When this sensor senses the magnetic field, it closes the path else it opens the path [5]. The object counter uses an LDR and a Laser diode to detect the intervention of any object. There are several categories of RFID available but we can separate RFID gadgets into two categories, they are active and passive.

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Active RFID systems use battery-powered RFID tags that endlessly broadcast their own signal. Active RFID tags are used to track the real-time location in high-speed environments. Passive RFID systems use tags with no internal power source and instead are powered by the electromagnetic energy transmitted from an RFID reader. This is because the active tags will be augmented to the moving vehicle for tracking applications, where in the precision depends on GPS which in turn consumes more power. On the other hand the applications may be static reading and hence so the least power required for modeling and there will be no effect due to the maintenance factor.

IV. TECHNOLOGY DESCRIPTION

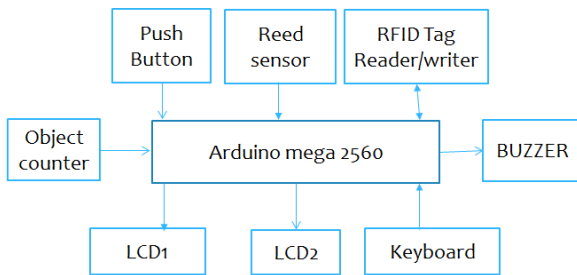


Figure 1: Block Diagram Of The System

The basic memory structure of the MiFare RFID tag was shown in figure 2. This card has 16 identical sectors. Each sector contains 4 blocks. Each block contains 16 bytes. In each sector the last block is called Trailer Block. This block is very useful for authentication. First 6 bytes of the trailer block is key A(k1), following next 3 bytes are control conditions, next byte is user data and last 6 bytes are key B(k2). Depends upon the control condition of k1 and k2, users gain the read access or write access or read/write access. The intruder can't access the tag without knowing key. In order to read or write data in RFID Tag first we need to authenticate with k1 or k2.

Sector	Block	Byte Number within a Block																Description
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
15	3	Key A						Access Bits			Key B						Sector Trailer 15	
	2	Data																Data
	1	Data																Data
	0	Data																Data
14	3	Key A						Access Bits			Key B						Sector Trailer 14	
	2	Data																Data
	1	Data																Data
	0	Data																Data
1	3	Key A						Access Bits			Key B						Sector Trailer 1	
	2	Data																Data
	1	Data																Data
	0	Data																Data
0	3	Key A						Access Bits			Key B						Sector Trailer 0	
	2	Data																Data
	1	Data																Data
	0	Data																Manufacturer Block

Figure 2 (Memory Structure of RFID Tag)

Depends upon the access condition key A and Key B users gain the read access or write access or read/write access. The intruder can't access the tag without knowing key. In order to read or write data in RFID Tag first we need to authenticate with key A or Key B. A person holding a RFID card can recharge his card[3] by giving the password of his card which adds security to the card. Driver first presses the keyboard to specify the route to which the bus is boarding. A person entering the bus swipes the RFID card, its Id is

noted and the RFID inout flag is made 1 and the total number of passengers accompanying

Table 1 D-Block Control Bit Action Block (0-2)

Control Bits			Control Condition				APPL
X1	X2	X3	READ	WRITE	Update	DEC / TRANS / REST	
0	0	0	k1/k2	k1/k2	k1/k2	k1/k2	Transport
0	1	0	k1/k2	No Action	No Action	No Action	Read/Write Block
1	0	0	k1/k2	k2	No Action	No Action	Read/Write Block
1	1	0	k1/k2	k2	k2	k1/k2	Value Block
0	0	1	k1/k2	No Action	No Action	k1/k2	Value Block
0	1	1	k2	k2	No Action	No Action	Read/Write Block
1	0	1	k2	No Action	No Action	No Action	Read/Write Block
1	1	1	No Action	No Action	No Action	No Action	Read/Write Block

Table 2 Sector Trailer Access Bit Rules (Block 3)

Control Bits			Control Condition						Remarks
			KEY A		Control Bits		KEY B		
X1	X2	X3	READ	WRITE	READ	WRITE	READ	WRITE	
0	0	0	No Action	k1	k1	No Action	k1	k1	Transport
0	1	0	No Action	Never	k1	No Action	k1	No Action	Key A is able to read Key B
1	0	0	No Action	k2	k1/k2	No Action	Never	k2	
1	1	0	No Action	No Action	k1/k2	No Action	No Action	No Action	-
0	0	1	No Action	k1	k1	k1/k2	k1	k1	-
0	1	1	No Action	k2	k1/k2	k2	No Action	k2	-
1	0	1	No Action	No Action	k1/k2	k2	No Action	No Action	-
1	1	1	No Action	No Action	k1/k2	No Action	No Action	No Action	-

V. OPERATION OF THE PROPOSED SYSTEM:

A person holding a RFID card will recharge his card[3] by giving the positive identification of his card that adds security to the card. Driver initially presses the keyboard to specify the route to that the bus is boarding. A person getting into the bus swipes the RFID card, its Id is noted and therefore the RFID in out flag is formed one and therefore the total range of passengers concomitant is specified through keyboard [7]. The object counter placed next to the RFID reader/writer counts the person getting into the bus and if the person exceeds the count, buzzer makes a sound for notification. The Reed sensor device interfaced with the Arduino board is placed close to the bus wheel and a magnet is connected to the wheel at a distance of 2cm between them. Whenever the wheel rotates and therefore the magnet crosses the reed device, count values are augmented to point the number of rotations of the wheel. Driver presses the electrical switch to point subsequent stop once it's reached. Once a similar RFID is swiped, the RFID in-out is formed zero, and the distance is calculated by the product of amount of rotations and circumference of wheel [8]. Amount is withdrawn from the card as per Lookup table. LCD1 displays the RFID number, total distance travelled, and the balance amount.

Table 3 Lookup Table

Start point	End point	Distance travelled $x_n = Q - P$	Amount With-drawn	Balance withdrawn
P1	Q1	$a_1 < x_1 < b_1$	Y1	Balance-Y1
P2	Q2	$a_2 < x_2 < b_2$	Y2	Balance-Y2
.
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Pn	Qn	$a_n < x_n < b_n$	Yn	Balance-Yn

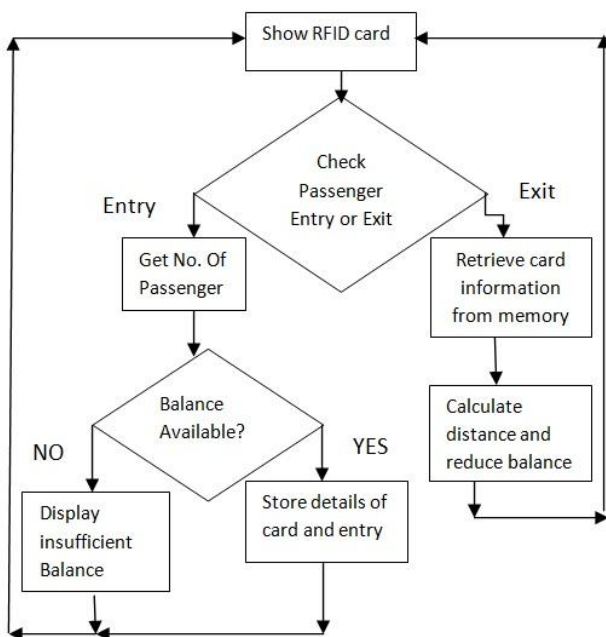


Figure 3 Flow Diagram of proposed system.



Figure 4 Hardware Implementation.



Figure 5 Output Display upon interfacing.

From figure 4 and 5 it is observed that, LCD, Keyboard, and RFID reader/writer have been interfaced with the Arduino Board which displays the travel point to be selected and further the locations, fare are indented to control via controller.

VI. CONCLUSION

The ticketing assistance system is meant to be unconditionally machine-driven, reliable, clear and optimized which may be meritoriously used for vehicle on highways for user's toll fee payment. The cards being returnable, they're far more convenient compared to the recently available ticketing system. Digital cards can also be accustomed be a complete transport pass and that may permit any transportation on any route.

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S.Sridhar Raj obtained his Bachelor's degree in Electronics and Communication Engineering, Masters in VLSI Design in the years 2011 and 2013 respectively. He has 6 years of teaching experience with the alongside research area of interest includes Analog VLSI, Low power VLSI, Testing of VLSI. He has published about 13 papers in the journal/ conference at the national and international level. He is a life member in ISTE & IETE.



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