

# AUTOMATIC E-TOLL TICKETING AND VEHICLE SAFETY USING EMBEDDED TECHNOLOGY

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**Abstract:** *In this paper we proposed an improved form of tollgate billing system. In our work, once the end user (motorist) comes to chargeable zone; the RSSI transceiver receives the signal that the vehicle has entered the chargeable zone particular LANE, then automatically the unique id of the motorist (Vehicle ID) has been read via on-board unit, which has been attached to every vehicle and collects the daily road pricing charge. In safety features, we included Adaptive Front-lighting System(AFS) and Vehicle Shutdown. The proposed work is implemented through hardware.*

**Key words:** *Radio Frequency Identification (RFID); RF Modules; Electronic Toll; Server; MEMES System*

## 1. Introduction.

Every time the person passes a tollgate he/she has to wait in the queue and should swipe his smart card for making payment. This is time-consuming and tollgates must have staffs to assist in this process (man power). The Gate which is available in the toll gate takes a minimum amount of time to open/close by the motor action every time though the motorist made the payment in time. Few of existing projects based on RFID tag, which consume more power because reader and tags required power. Active tags are expensive because of their complexity. Active tags comprise an antenna, microchip, and radio transceiver, increasing the cost of the system. The other disadvantage is collision. The disadvantages of existing systems are Long Time Needed to cross the toll area, Complexity, More Collision when tag access at same time, Because of complexity cost may increased in active tag and Heavy Traffic. The literature survey are [1] "Radar: an in-building rf-based user location and tracking system" In this paper, the proliferation of mobile computing devices and local-area wireless networks has fostered a growing interest in location-aware systems and services. In this paper we present RADAR, a radio-

frequency (RF) based system for locating and tracking users inside buildings. RADAR operates by recording and processing signal strength information at multiple base stations positioned to provide overlapping coverage in the area of interest. It combines empirical measurements with signal propagation modeling to determine user location and thereby enable location aware services and applications. We present experimental results that demonstrate the ability of RADAR to estimate user location with a high degree of accuracy. [2] "The limits of localization using signal strength: a comparative study" In this paper, We characterize the fundamental limits of localization using signal strength in indoor environments. Signal strength approaches are attractive because they are widely applicable to wireless sensor networks and do not require additional localization hardware. We show that although a broad spectrum of algorithms can trade accuracy for precision, none has a significant advantage in localization performance. We found that using commodity 802.11 technology over a range of algorithms, approaches and environments, one can expect a median localization error of 10ft and 97th percentile of 30ft. We present strong evidence that these limitations are fundamental and that they are unlikely to be transcended without fundamentally more complex environmental models or additional localization infrastructure. [3] "Mote track: A Robust, decentralized approach to rf-based location tracking" In this paper, we present a robust, decentralized approach to RF-based location tracking. Our system, called Mote Track, is based on low-power radio transceivers coupled with a modest amount of computation and storage capabilities. Mote Track does not rely upon any back-end server or network infrastructure: the location of each mobile node is computed using a received radio signal strength signature from numerous beacon nodes

to a database of signatures that is replicated across the beacon nodes themselves. This design allows the system to function despite significant failures of the radio beacon infrastructure. In our deployment of MoteTrack, consisting of 23 beacon nodes distributed across our Computer Science building, we achieve a 50th percentile and 80th percentile location-tracking accuracy of 0.9 and 1.6 m respectively. In addition, MoteTrack can tolerate the failure of up to 60% of the beacon nodes without severely degrading accuracy, making the system suitable for deployment in highly volatile conditions. We present a detailed analysis of MoteTrack's performance under a wide range of conditions, including variance in the number of obstructions, beacon node failure, radio signature perturbations, receiver sensitivity, and beacon node density. [4] "Relative Location Estimation in Wireless Sensor Networks" In this paper Self-configuration in wireless sensor networks is a general class of estimation problems that we study via the Cramér–Rao bound (CRB). Specifically, we consider sensor location estimation when sensors measure received signal strength (RSS) or time-of-arrival (TOA) between themselves and neighboring sensors. A small fraction of sensors in the network have a known location, whereas the remaining locations must be estimated. We derive CRBs and maximum-likelihood estimators (MLEs) under Gaussian and log-normal models for the TOA and RSS measurements, respectively. An extensive TOA and RSS measurement campaign in an indoor office area illustrates MLE performance. Finally, relative location estimation algorithms are implemented in a wireless sensor network test bed and deployed in indoor and outdoor environments. The measurements and test bed experiments demonstrate 1-m RMS location errors using TOA, and 1- to 2-m RMS location errors using RSS. [5] "Beyond Average: Toward Sophisticated Sensing with Queries" In this paper High-level query languages are an attractive interface for sensor networks, potentially relieving application programmers from the burdens of distributed, embedded programming. In research to date, however, the proposed applications of such interfaces have been limited to simple data collection and aggregation schemes. In this paper, we present initial results that extend the Tiny DB sensor net query engine to support more sophisticated data analyses,

focusing on three applications: topographic mapping, wavelet-based compression, and vehicle tracking. We use these examples to motivate the feasibility of implementing sophisticated sensing applications in a query-based system, and present some initial results and research questions raised by this agenda. [6] "Experimental Analysis of RSSI-based Location Estimation in Wireless Sensor Networks" With a widespread increase in the number of mobile wireless systems and applications, the need for location aware services has risen at a very high pace in the last few years. Much research has been done for the development of new models for location aware systems, but most of it has primarily used the support of 802.11 wireless networks. Less work has been done towards an exhaustive error analysis of the underlying theories and models, especially in an indoor environment using a wireless sensor network. We present a thorough analysis of the Radio Signal Strength (RSS) model for distance estimation in wireless sensor networks through an empirical quantification of error metrics. Further on the basis of this experimental analysis, we implement a k - nearest signal space neighbor match algorithm for location estimation, and evaluate some crucial control parameters using which this technique can be adapted to different cases and scenarios, to achieve finer and more precise location estimates.

## 2. Proposed System

The system we propose doesn't need smart card. The vehicle is enabled with a on-board unit that contains the vehicle id and information. Since WSN can addressing 16-bit addressing, more number of vehicles can pass freely. In this paper, once the end user (motorist) comes to chargeable zone the Zigbee transceiver receives the signal that the vehicle has entered the chargeable zone particular LANE, then automatically the unique ID of the motorist (Vehicle ID) has been read via on-board unit, which has been attached to every vehicle and collects the daily road pricing charge. Here, we going to use Two nodes. Each Node contains two individual tags to identified the authentic person. Tags are based on passive RFID(Radio-frequency identification), So that one tag of one node cannot be used in another node. Each Tag has unique code number for authentication. If we use

another tag instead of specified tag, then buzzer will produce a sound and usage of tags can be monitored in host. The Adaptive Front-lighting System (AFS) is one part of the active safety system of a middle-high end passenger car, providing an optimized vision to the driver during night time and other poor-sight conditions of the road by adapting the headlight angle and intensity, and judging the speed of the car, the steering wheel angle, the weather condition, and yaw and tilt rate of the car. To facilitate a user's development of such a system and to demonstrate the performance of TI's automotive MCU family, a reference design of AFS is developed. This article describes the functions of the reference design, as well as the implementation. Furthermore, it states the guidelines for manipulating the demonstration of the reference design.

### **3. Principle of operation**

The automatic toll e-ticketing system is the approach used for the vehicle when it reaches the toll plaza, this is detected by using Infrared Proximity Sensor. RFID tags are used to read each vehicle with the help of RFID reader. An IR receiver is used to receive these pulses and sends it to a controller (MSP 430 Launch pad), which then transmits the vehicle number through the RF transmitter located in vehicle. We assume that vehicles have 16-bit identification numbers. The RFID tags to readers read the signal and information about vehicles owners. These RF signals are received by an RF receiver at the toll plaza, which send data to a computer's parallel port. A software program running on the computer retrieves vehicle details from its vehicle database.

Depending on this information, appropriate toll tax is deducted from the pre-paid account of the vehicle's owners. The owner receives an SMS message on his/her mobile about the details of the payment. If the balance in the owner's account is low or if the vehicle is not equipped with an RF system, the toll gate remains close. Next method proposes a very simple method for enhancing the performance of infrared electronic-toll-collection systems, in such a case, the vehicle owner will have to pay the toll tax in case and collect the receipt. We need a system for handling violation and acknowledgement when a vehicle does not have an RFID module installed, a vehicle's ID number is not found in the database, or a driver has

insufficient funds to pay toll. If an acknowledgement is not received in a predefined time from the database, the toll plaza gate remains closed. Existing automatic toll collection techniques incur power loss since the receiver is continuously turned on, even when no vehicle arrived at a toll plaza. In our technique, only the IR sensor is turned on to detect the arrival of vehicles. Only when a vehicle is detected, RFID Tag to RFID reader reads the data. The advantages are more number of vehicles can pass freely, avoid traffic, less cost, more security, optimizing collision, easy To maintain and no service person is needed.

### **4. Hardware implementation**

RFID technology is taking off in Transportation at an increasingly rapid pace. Though there are few transportation companies employing this technology today, but due to its customizable feature and continuing improvement the communities are beginning to get involved in its development. It is easy to envision that, the RFID tags contents will increase in power, prices are expected to decline and tag will dramatically improve its efficiency, security and accuracy. Also major concerns need to be addressed for successfully implementing this technology. So that it will change our personal and work lives in transportation and adorns the conventional transportation management with a new idea and usher for a bright future

The automotive headlight should not be a passive device that can only be completely switched on or off. It should be capable of adapting to the environment to improve safety in poor visibility conditions. Moreover, the design for adaptive headlights should not be limited to a single task. It should be capable of performing many different tasks to help the driver in multiple road environments. Our headlight design provides unprecedented light beam control over space and time. We have demonstrated the flexibility of the headlight for numerous tasks: allowing drivers to use high beams without glaring any other driver on the road, allowing drivers to see better in snow, and allowing better illumination of road lanes, sidewalks and dividers. Our prototype can quickly react to the road environment within 1 to 2.5 milliseconds, and, thus does not create any flicker to be seen by the human eye. Further research and development is needed to make the prototype compact to fit within actual vehicle headlight

compartments. Further engineering is required to make the system reliable in the presence of vehicular vibrations and heat. Lastly, more sophisticated algorithms and reliable software need to be developed before deploying our headlight design. Fig 1 and 2 display the block diagram of vehicle and server.

In this paper, we have proposed a novel method of vehicle tracking and locking systems used to track the theft vehicle by using GPS and GSM technology. This system puts into the sleeping mode vehicle handled by the owner or authorized persons; otherwise goes to active mode. The mode of operations changed by persons or remotely. When the theft identified, the responsible people send SMS to the micro controller, then issue the control signals to stop the engine motor. After that all the doors locked. To open the doors or to restart the engine authorized person needs to enter the passwords. In this method, easily track the vehicle place and doors locked. Fig.3 shows the entire hardware setup. Figs. 4 to 14 displays the various internal parts of hardware setup.

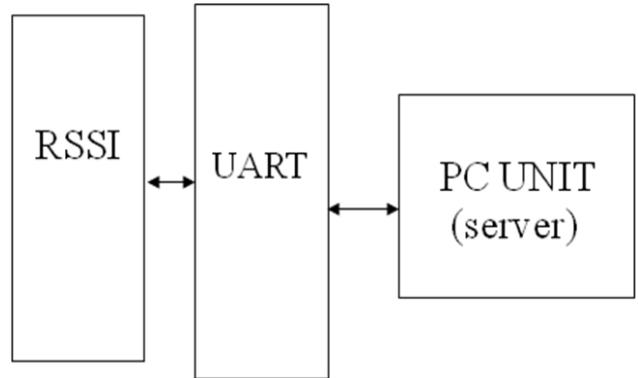


Fig. 2 Master Receiver and Control Side (Tollbooth)

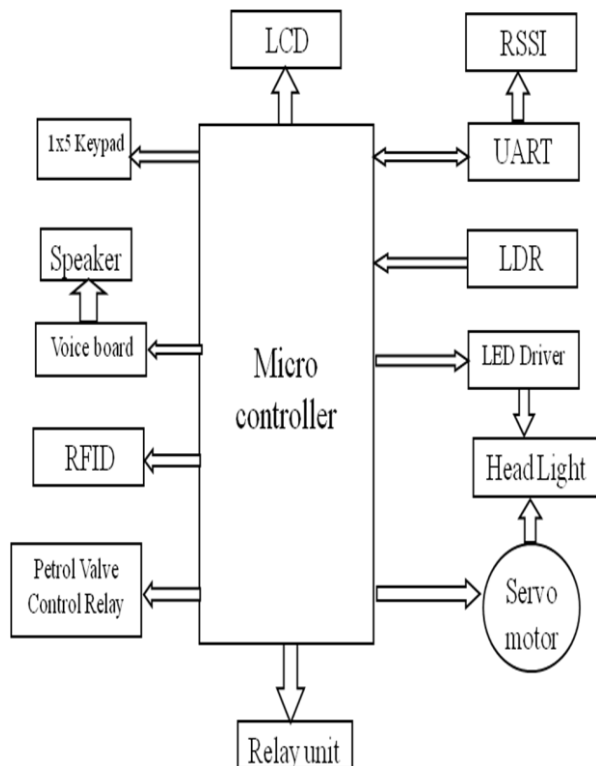


Fig. 1 Block Diagram: on Board Unit (Vehicle Side) Transmitter Section

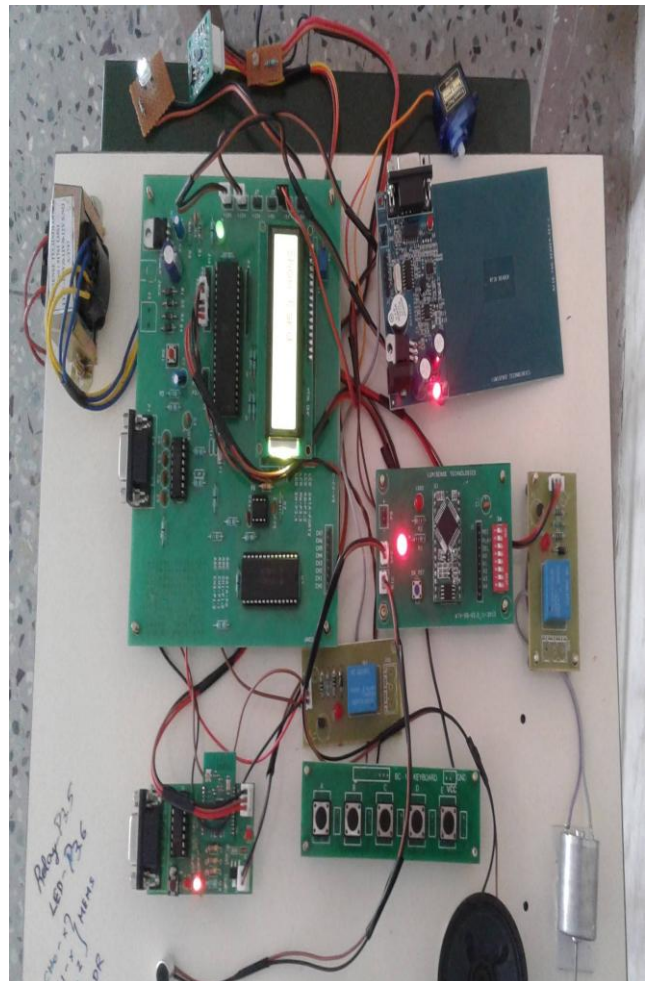


Fig 3. Hardware Prototype



Fig 4. RFID tags installed in the vehicle

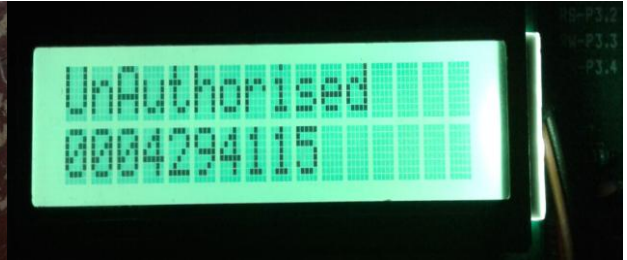


Fig 8. Output when unauthorized vehicle enters

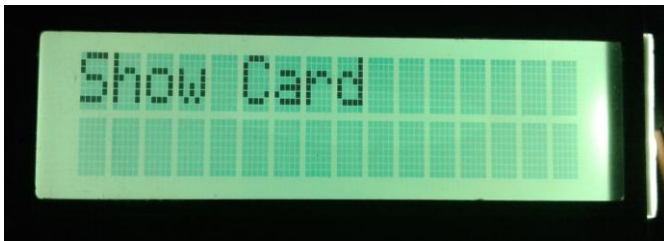


Fig. 5. Output before the vehicle entrance

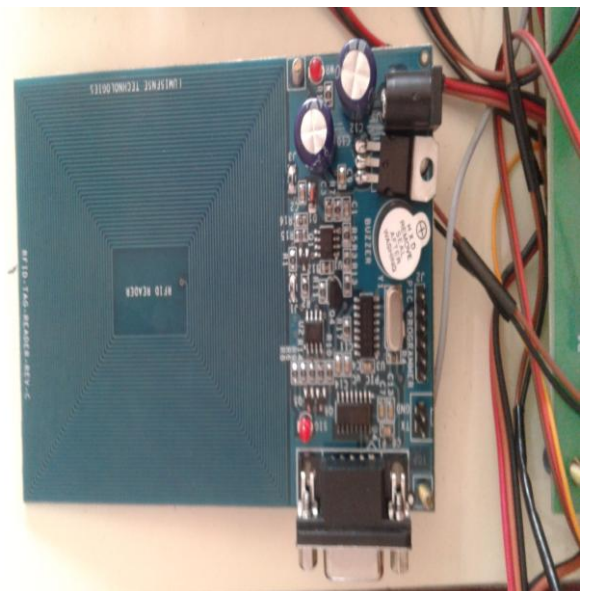


Fig 9. RFID reader

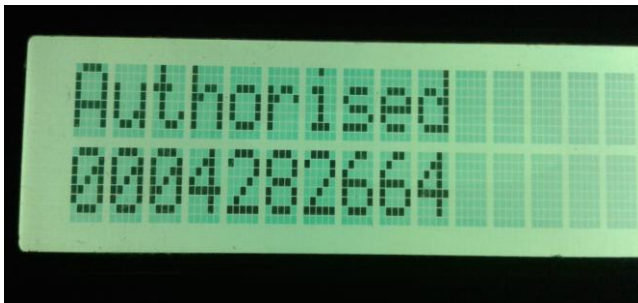


Fig. 6. Output after the authorized vehicle entered



Fig 7. Registration details of authorized vehicle

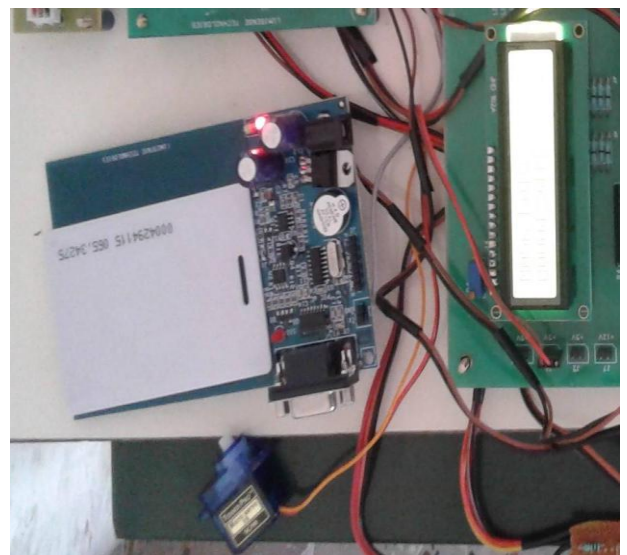
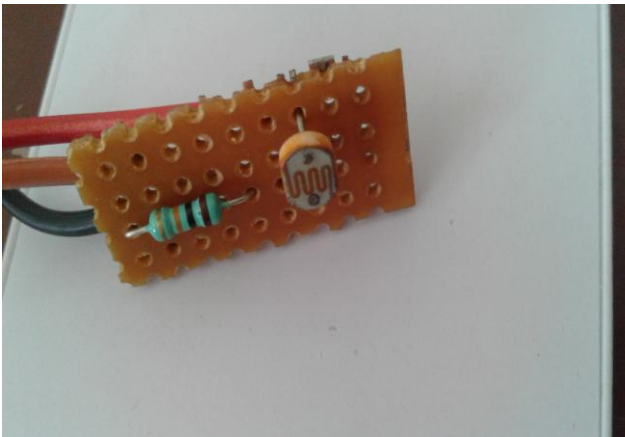


Fig 10. RFID tag while reading



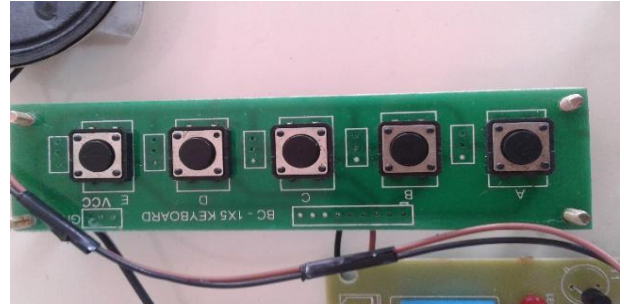
**Fig 10. MEMS system**



**Fig 11. Light Dependant Resistor**



**Fig 12. Adaptive headlight system**



**Fig 13. Keypad**



**Fig 14. Server System**

## 5. Conclusion

In this paper, the concept of Automated toll e-ticketing using microcontroller. We have used an innovative approach where a traveler will be able to pay the toll while in motion using RFID communication technology. Through this process of toll collection will save time, effort, and man power. How many vehicles passing through the toll gate stored in a database. We can also find out a vehicle how many times passing through the toll gate in a day. The improvement can be done to develop a multi vehicle amount deducted and send a SMS at a time multi

vehicle.

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