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Smart Towing System

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ABSTRACT: Radio Frequency Identification (RFID) technology is a very useful technology in automation. RFID along with Arduino can be used to monitor illegal parking of vehicles at specific places in city which is one of the most challenging issues in big cities. This paper proposes a system that will monitor illegal parking of vehicle and alert the owner via an email that will consist of fine amount and the due date of fine payment. The RFID tag on vehicle will act as transmitter and the Arduino along with RFID reader module will act as a receiver.
Keywords:RFID; Reader Module; Automation; Arduino; Parking

I. INTRODUCTION

The Arduino platform has become quite popular with people working out with electronics. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making programming easier. RFID is the use of radio waves to read and capture information stored on a tag attached to an object. Using these robust features of Arduino and RFID, we'll be monitoring unauthorized parking of vehicles at specific places in an efficient manner.

We all face a lot of unnecessary traffic on road every day and the major reason behind that is vehicles parked in no parking area. Several towing services run in city to ensure that vehicles parked in no parking area are towed and a fine is collected from the owner to claim the vehicle back. However, this is a manual process and thus it is neither available 24*7 nor 100% accurate. An automated and efficient process to handle this is all we need. The proposed project can be a part of "Digital India" initiative as the unauthorized parking will be detected automatically, fine amount for the same will be paid online. System will be able to read and identify the type of parking within range of 50m distance. Both two & four wheeler vehicles will be the vehicles under surveillance. As RFID reader does not require line of sight, the reading of tag will be much efficient. RFID tag used here in the proposed system will work at frequency 13.56MHZ. This system will further help to explore the limitations of Arduino UNO3 and RFID technology.
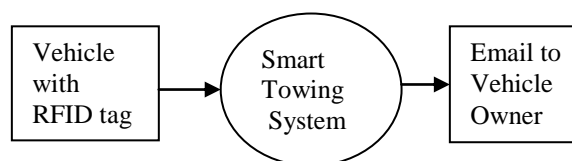

Fig.1 Basic System Diagram

The RFID tag on vehicle will be scanned and the system will process the scanned data. If the parking is found out to be illegal/invalid then a challan will be generated and sent to the vehicle owner via an e-mail.

II. RELATED WORK

There has been various system developed using RFID and Arduino that helps us in understanding the functionality of these technologies. These systems not only help in understanding the functionalities but also helps to explore the limitations of same.

As there is a demand for secure system that must be dependable and quick respond for the industries and company. Grewal Kaushal, Rishabh Mishra, etal. have proposed a solution for Security and Access control using RFID and Arduino along with GSM module. Arduino UNO board with Atmega328 microcontroller and EM-18 RFID reader module is used which will retrieve information stored in RFID tags. However, this system is only concerned with Security and Access Control but helps in understanding the functionalities of Arduino and RFID to a larger extent [1].

A solution proposed by Norsuzila Ya'acob, Syed Fudhail Syed Adnan, etal. For lab management

using Arduino microcontroller approach associated with webpage where they have used Visual Basic to design webpage. It is a combination of hardware and software project that makes use of RFID technology to identify students uniquely and displays dynamic information on the webpage [2].

Another solution proposed by S. C. Hanche, Pooja Munot, etal. Which makes use of RFID tag to assign a parking lot to vehicles. RFID tag is read and user is validated from the database by validating user credentials. After validation, parking fee is deducted from the wallet and then parking lot is allotted. Through this system, we achieve automated parking process and same logic can be used to implement our system that will prevent unauthorized parking in near future. The major disadvantage of this is it doesn't eliminate lines and traffic jams on both entrance and exit [3].

Automated Smart trolley is the system developed by uganya.R. R, Swarnavalli.N, etal. that makes use of Arduino and RFID. Arduino microcontroller is fixed on the trolley and as soon as the customer keeps any item in the trolley, the RFID reader reads the tag on product and keeps adding the price in the total price. However, this system doesn't keep record of the items purchased and at the end it only displays the no. of items and total price [6].

With the help of all these related work in the field of automation, we'll automate the towing process. These related works help us understand the basic functionalities of Arduino hardware and RFID technology. The robustness of these technologies makes it possible to achieve the level of accuracy desired in the proposed system.

III. PROPOSED SOLUTION
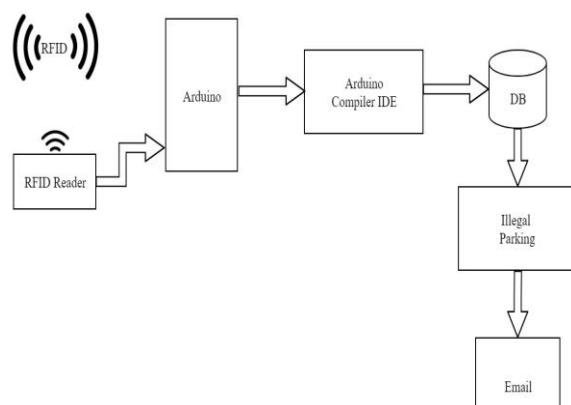
A. System Architecture

Fig.2 System Architecture

System is composed of various components, each of them has their own functionality:

RFID tag: A tag that consists of an unique identification and can withstand harsh environments.

RFID reader: A reader module embedded to scan the tag details, the module used in the proposed system is RC522 which operates at frequency 13.56Mhz.

Arduino: The most important component in the system that holds everything together. It comes with a microcontroller that executes the set of instructions loaded into it.

Arduino IDE: Provides an environment for the system developer to write and execute the desired code. The liobrary required must be loaded before executing the code.

DB: The scanned data is stored in the database for further processing. The data here will be transferred with the help of putty serial logger software and PHP language. The database is created and maintained in Xampp software.

Illegal Parking: A list of all the vehicles that violates the norms.

Email: An email consisting of challan is sent to all the vehicle owners who fall in above list.

B. Algorithm

Step 1: Start

Step 2: Assign a rfid tag to every vehicle.

Step 3: Start the system/scanner to scan the rfid tag/vehicle in range.

Step 4: System sends the scanned data to the computer's database

Step 5: System evaluates the time difference between two scans.

Step 6: Formula to evaluate the type of parking:

$Result(R) = (T1-T2) \div 1000$

Where,

$T1$ = In Time(milliseconds)

$T2$ = Out Time(milliseconds)

Step 7: For a no parking area of length 50 meters,

$R<30$, Valid Parking

$R>30$, Invalid Parking

Step 8: Based on above value of R, system generates a list of illegally parked vehicles.

Step 9: System sends the fine challan consisting of fine amount, due date and payment link via an email to the owner.

Step 10: Vehicle owner visits the web application through the payment link and makes the payment.

Step 11: After successful payment, system updates the fine amount for that user as 0.

Step 12: Stop

C. Working

Consider an example of No parking area outside a hospital gate where parking is not allowed within 50m distance on both sides, basically the total No parking area is 100m. We will install our receiver circuit having range of 50m at both ends that will read the RFID tag no. and time of scan. Even in the worst scenario, to cover a distance of

100m a vehicle should not take more than 2min. Now, the system will calculate the difference between two successive scans of a particular RFID tag and if the difference comes out to be more than 2min., which means the vehicle was illegally parked in between. System will now generate a fine amount with all necessary details for that particular RFID tag and will alert the owner via an E-mail. Payment for the same will be processed from our Web Application where user will have to register first and later login to check details for the fine and proceed with the payment (if any).

IV. IMPLEMENTATION

A. Specific Requirements:
- Personal Computer with aleast the following features:
    - Intel i5 5th gen processor or above
    - 4 GB RAM
    - 500GB HDD
- Components:
    - RFID Reader Module: 1
    - RFID Tags: 3
    - USB Cable: 1
    - Arduino Board: 1
- Arduino IDE software
- Xampp Server
- Windows OS 7+
- PuTTY
- HTML, PHP, CSS technology

B. Performance Metrics:
- Availability: 24*7
- Range of scan: Scans rfid tag within range of 5m in fraction of a second
- Maintainability: Not much effort is needed once the system is setup completely
- Modifiable and extensible as per the requirement
- Reliability: Consistent and dependable quality of service

V. RESULT

The system comprises of both hardware and software part. The hardware part deals with scanning of data and the software part handles the processing of scanned data. A web application is created for users to check their profile and make payment of any pending amount. The admin panel deals with registering a vehicle with a unique rfid number and sending reminder SMS when the due date is near. Admin also has the provision to see all the transaction details and all legal/illegal parking details for smart towing system.

Fig.3 Admin Page

Above Fig.3 shows the valid and invalid users to the admin. This page displays total numbers of users that have been registered as valid and invalid depending on the activity of the vehicle owner.

Fig.4 User Profile Page

Above Fig.4 displays the user profile after successful login. It displays user details and fine amount to be paid. The user can proceed with the payment (if any) by clicking on "Pay" or logout of the system.

VI. FUTURE SCOPE
- The range of scan can be increased with the use of more powerful scanners.
- Instead of installing this system at specific places, it can be implemented for entire city.
- A camera can be embedded with the system that will capture the snapshot of vehicle number as a proof.
- GPS module can also be embedded with the system to detect the exact location.

VII. CONCLUSIONS

The verification shows that the Smart Towing System using RFID and Arduino can be established. It's effective and response time delay is within 10 second. The total cost of System infrastructure can be reduced by using the exactly required components that match our specifications. This smart towing service makes it easier to reduce the traffic at prone areas and RTO can also manage it alongside the RTO norms. The system is ideal for an apartment, hospitals, schools, college parking areas. Use of RFID for unauthorized parking service

offers utmost efficiency, convenience, safety & reliability.

The system can be made even more effective by adding various factors that can be considered for illegal parking. Other fields like Mall parking, Hotel Parking, Automated vehicle service management, etc. can be done. It is an ideal solution for today's car parking and traffic problem in cities.

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