**SSN COLLEGE OF ENGINEERING**

**KALAVAKKAM-603110**

**INTERNALLY FUNDED STUDENT PROJECT-2019**

**ADVANCED SECURITY SYSTEM INTEGRATED WITH INTELLIGENT TRANSPORTATION SYSTEMS**

**A PROJECT BY**

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**PROJECT GUIDES**

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**BUDGET: Rs. 20000**

**PROJECT DURATION: 12 months**

Signature of the Project Students Signature of the Project Guide

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**1. Project Title:**

ADVANCED SECURITY SYSTEM INTEGRATED WITH INTELLIGENT TRANSPORTATION SYSTEMS

**2. Broad Subject:** Transportation System management

**3. Project Duration (in months):** 12

**4. Budget (in thousands):** Rs Twenty thousand

**5. Project Summary**

This project addresses the potential for increased Transportation system efficiency through the use of Intelligent Transportation Systems (ITS). The ITS technologies proposed can help to optimize trips, diminish unnecessary miles/kilometres travelled, increase road safety, reduce time spent in congestion and improve air quality.

In this project, we would be implementing ITS technologies like density-based traffic signal control systems and Automated toll collection.

Automated toll Collection System is prevalent in many countries like Malaysia, Japan and India as well, although not every toll has been automated.   
The National Electronic Toll Collection (NETC), run by the National Payments Corporation of India (NPCI), now accounts for 25% of the toll collected on India’s highways. It uses electronic tags, called FASTags, to deduct the toll from a linked bank account, allowing customers to drive through toll plazas without stopping.

Our solution promises to be infallible since the RFID chips will be embedded in the Government issued license plates to increase longevity and also to prevent mishandling. Also, image processing of the license plate number will be done in case the RFID chips become unreadable. This solution also helps us to make a smooth transition to a fully functioning Electronic Toll Collection system using RFID until which the cars without the newly embedded chips can be identified through image recognition of their license plate numbers.

Our project also proposes an advanced security system integrated with the Automated Toll collection System that blocks the vehicles that have been flagged by the police at the Toll. The barricades will not be opened and bars will ascend from beneath the ground to jail the allegedly accused person along with his/her car.

We also plan on implementing a density-based traffic signal control system that changes the timing of the signal based on the density of vehicles on each side.

**6. Keywords:**

RFID technology, image recognition/processing, scheduling traffic signal timings, Electronic Toll collection, Density-based Traffic Signal Control

**7. Objectives**

* To speed up toll collection and increase effectiveness using RFID and image processing technology
* To increase security at tolls by providing mechanism to block vehicles flagged by the police
* To lessen the traffic congestion in major and minor roads alike, thereby reduce pollution and accident frequency
* To provide infallible new number plate system which will be fool-proof against false number plating

**8. Introduction**

RFID or radio frequency identification is used in the form of chips embedded within the number plates. These chips and the number plates are issued by the government and are not meant to be handled by the users. Number plates are fixed per vehicle and so are the RFIDs. Any mishandling would lead to flagging by RFID readers which are coupled with image processing number plate readers for better security.

Density based traffic management is the main role of image processing cameras, which use the traffic present and works out a plan for management without issues. This system automatically recognises special status vehicles like ambulances, active police vehicles etc and provides necessary traffic alignment.

RFIDs are also used as basis for automated toll collection and security system based on flagging of vehicles in police database. Database maintenance of RFID and coupled registration numbers and vehicle information is required.

**9. Definition of the Problems**

Traffic congestion leads to several problems such as air pollution and public nuisance, but most importantly it leads to increased road accidents and road rage, which are interlinked. If traffic is unchecked, it leads to serious issues like air toxicity AND behavioural toxicity.

At toll booths, reading the number plates manually or scanning the RFIDs in person leads to delay and therefore, again, congestion. Also, these toll booths serve as potential points to stop fleeing criminals or to inspect suspicious vehicle activity, a potential which is not tapped effectively.

**10. Review of status of Research and Development in the subject**

**10.1 National Status**

India has an existing RFID system, FASTag, for toll booths. **FASTag**is an [electronic toll collection](https://en.wikipedia.org/wiki/Electronic_toll_collection) system in [India](https://en.wikipedia.org/wiki/India), operated by the [National Highway Authority of India](https://en.wikipedia.org/wiki/National_Highway_Authority_of_India) (NHAI). It employs Radio Frequency Identification (RFID) technology for making toll payments directly from the prepaid or savings account linked to it or directly toll owner. It is affixed on the windscreen of the vehicle and enables to drive through toll plazas without stopping for transactions. But most of the toll gates are dependent on manual scanning. Traffic control system in our country is based on fixed algorithms which do not take the present road traffic and vehicle density into consideration.

**10.2 International Status**

Countries like Singapore are undergoing research into Intelligent Transport Systems and are increasingly automating their traffic control system and road security. Italy is the first country to fully automatize its toll collection system. Similar research is ongoing in several countries.

**11. Novelty Importance of the proposed project in the context of current status**

The project aims to completely automate the process of toll collection while maintaining the degree of accuracy. To do this, RFID and Image Processing are used in conjecture, implementing a 2-way authentication for processing vehicle IDs. Such a dual system has not been implemented anywhere yet, due to its difficulty of implementation. This project uses advanced yet efficient image processing techniques to reduce toll on processors so that desired results can be achieved in minimal time. This also enables us to easily identify stolen vehicles which makes every toll gate an anti-theft scanner. This project further uses the data from both inputs to calculate vehicle density. The data then can be used to nearby signals, allowing much better traffic management.

**12. Patent details (domestic and international), if applicable**

There would be no need for any patents because it's based on combination of existing technologies.

**13. Work plan and Detailed technical information**

**13.1 Methodology**

The project will be divided into 2 main divisions: RFID and Image Processing. For implementing RFID based toll automation, we use UHF band RFID Tags and Readers (865-928 MHz). These are chosen for their long range, compactness, accuracy, high speeds and less interference with surrounding materials. The tags are embedded into a model license plate by soldering. The reader is connected to a microprocessor (Raspberry Pi in this project) via Wi-Fi or Ethernet. A python code is uploaded to Pi to control the reader and process the IDs. This is then matched to a database to find the user and deducts the required money (any preferred payment system). If the database cannot find the user ID, it will notify the user and the authorities. If a vehicle tries to bypass the system by interfering with the tags, the system then proceeds to barricade the vehicle when it crosses. Other vehicles will then be redirected.

For Image Processing, we use state-of-the-art cameras (long range) to detect license plates in high resolution even in extreme weather and low-light conditions. We use machine learning algorithm to train the system for annotating license plates. The cameras are also connected to Raspberry Pi. The data is then matched with the database to find the user credentials. This can be used to authenticate data from RFID. Further updates to algorithms can be introduced OTA. Sample images are used to train the system.

For Density traffic management system, RFID readers can be used in intersections to estimate the density of traffic. This data is updated to traffic control centres for better management of signal timings. Also, image recognition can be used to detect priority one vehicles such as ambulances and fire vehicles. Routing of such vehicles can be made easier. Virtual nav meshes are uploaded depending upon the road plan.

**14. Time schedule of activities giving milestones**

Time schedule of activities:

1. Initial setup of parts – 1 to 2 weeks
2. Algorithm creation for toll collection(Alpha) – 1 month
3. Algorithm creation for density traffic management(Alpha) – 1 month
4. Training algorithm with sample data-2 weeks
5. Setting up Miniature model for testing- 2 months
6. Testing all systems and acquiring feedback-2 weeks
7. Analysis of Test I- 2 weeks
8. Sampling more data and training algorithm(Alpha version 2)-1 month
9. Testing new algorithm with real-life situations-2 weeks
10. Analysis of Test II- 2 weeks
11. Improvements to Algorithm-2 weeks
12. Integrating Database and Payment methods-2 months
13. Final Report-1 month

**14.1 Time Schedule of Activities through BAR Diagram**

**15. Deliverables**

The objective of the project is to make the existing technology in roadways a better one.

The project promises to deliver the following outcomes:

* A miniature working model of the real time use of Intelligent Transportation Systems (ITS) using RFID chips and its respective chip reader with features specified in as in above.
* Image processing cameras with self-learning features to monitor and regulate traffic.

**16.Target beneficiaries of the proposed work**

Toll booths are the beneficiaries of the use of RFID chips and readers. This also helps the cops to track and get hold of criminals trying to evade the law. Linking of any of the government issued number plates to the RFID database ensures that every person is on the government’s datasheet. Image processing cameras benefit the everyday commuter as it ensures smooth operating of traffic signals based on density of vehicles as opposed to working on fixed timeframes.

**17. Suggested plan of action for utilization of research outcome expected from the project**

**17.1 As journal publication**

The ideas, working and results of this project can be published in the form of a paper or a journal.

**17.2 Patent filing**

There would be no need for any patents because it's based on the combination of existing technologies.

**17.3 Project preparation for submission to external funding**

The project aims to create a working miniature model including all the above-mentioned characteristics and demonstrate the working to internal funding and with approval to make larger scale project with real life applications using external funding.

**18. References**

Wikipedia

<https://blog.atlasrfidstore.com>,

<https://www.cctvcameraworld.com/connect-security-cameras-to-internet/>

<https://www.researchgate.net/publication/285670989_Intelligent_Transportation_Systems/link/59e25371aca2724cbfe011de/download>

**19.List of facilities and Equipment available with the department for the subject**

Expertise of project guide and access to the CSE labs.

**20. Budget Estimates**

An approximate estimate tells that the project would cost around Rs 20000

**21. Budget Justification**

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| --- | --- | --- | --- |
| **S.NO** | **Name of the Component** | **Qty** | **Price** |
| 1 | UHF RFID long range card reader | 1 | Rs.9000 |
| 2 | Cameras | 2 | Rs 3000 |
| 3 | RFID tagging chips | 10 | Rs.3000 |
| 4 | Model remote controlled car | 1 | Rs. 800 |
| 5 | LEDs, wires, aluminium foil, PVC pipes and other accessories | - | Rs.1200 |
| 6 | Raspberry Pi 3b+ model | 1 | Rs. 3000 |
|  | **Total** |  | **Rs. 20000** |