IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.53

Volume 4, Issue 1, May 2024

Fastag Scanning using Drone

Dr. S. S. Gundal[1], Vedant K. Barguje[2], Akshada G. Kanawade[3], Hindavi N. Bankar[4]

Faculty, Department of Electronics Engineering[1]

Students, Department of Electronics Engineering[2,3,4]

Amrutvahini College of Engineering Sangamner, Maharashtra, India

Abstract: *Report proposes the use of drones for Fastag scanning at toll plazas, aiming to revolutionize toll collection systems and improve traffic flow efficiency on national highways. The integration of drones offers real-time scanning capabilities and eliminates manual errors, focusing on efficiency, accuracy, and user experience improvement. The organizational structure includes specialized teams for technical development, infrastructure adaptation, data management, regulatory compliance, training, and public relations. A literature survey highlights the need for advancements in toll systems, and detailed component lists provide insights into the technical aspects of implementation. The report concludes with a summary of the benefits of the proposed system, while highlighting future enhancements in data management and regulatory compliance. The application section highlights its relevance in real-world scenarios.*

Keywords: Fast Scanning, Drones, Toll Plazas, Traffic Flow, RFID Technology, Efficiency, Innovation, Real-Time Monitoring System

I. INTRODUCTION

The proposed drone assembly aims to scan vehicles at toll plazas using RFID technology to promote cashless payment of toll taxes. The Fastag facility, implemented by the government to avoid long queues and jams on national highways, collects the entire toll tax amount through Fastag. The drone with scanner assembly is designed to control traffic flow and improve efficiency

Theme Of Project

The overarching theme of Fastag scanning using drones revolves around the fusion of cutting-edge technology and transportation infrastructure to create a more efficient, seamless, and future-ready toll collection system. This theme encompasses several key elements: Technological Innovation: At its core, the theme highlights the integration of drone technology into the traditional toll collection process. The use of RFID scanning and high resolution cameras on drones represents a leap forward in the pursuit of innovative solutions to enhance efficiency and accuracy.

Efficiency and Speed:

The theme emphasizes the need for a faster and more streamlined toll collection process. Drones, with their ability to capture Fastag information from vehicles in motion, epitomize the quest for efficiency, reducing congestion, and minimizing the time vehicles spend at toll booths.

Seamless Integration:

The theme underscores the importance of seamlessly integrating this technological advancement into existing infrastructure. The goal is to implement a solution that complements and enhances the current toll collection system, minimizing disruptions and costs associated with widespread modifications.

User Experience:

A key aspect of the theme revolves around improving the overall experience for commuters. By reducing wait times and eliminating manual errors, the Fastag scanning using drones contributes to a smoother and more user-friendly journey for those traversing toll booths.

Future-Ready Transportation: 4 the broader theme extends to the vision of a technologically advanced transportation ecosystem. Fastag scanning using drones serves as a precursor to future developments, signaling the potential for increased automation, data-driven traffic management, and continuous innovation within the transportation sector.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, May 2024

Need Of Project

Fastag scanning using drones is a revolutionary solution to the challenges of traditional toll booths, which often cause long queues, manual errors, and traffic congestion. The technology uses drones equipped with high-resolution cameras and RFID scanning capabilities to autonomously capture Fastag information from vehicles in motion. This real-time processing eliminates manual errors and ensures swift transactions, reducing congestion at toll booths. The technology also lays the groundwork for a connected and intelligent transportation ecosystem, allowing authorities to make informed decisions about infrastructure development, maintenance, and system optimization. The need for Fastag scanning using drones is driven by the need to evolve transportation systems into efficient, technologically-driven networks, paving the way for a future where the open road is seamlessly connected and travel becomes a smoother, smarter experience for all

II. OBJECTIVES

- To eliminate the delays and congestion associated with traditional toll booths
- To eradicate manual errors in toll transactions reliable and trustworthy toll collection system. Additionally, the integration of drones into the Fastag scanning process.
- To facilitate technologically advanced transportation for future developments in automated traffic management.

List of Components/Software Required

- Drone Controller.
- 1000kV BLDC motors.
- Arduino Mini-pro.
- 350mm Drone Frame.
- Flysky i6s Transmitter.
- AT89S52 Microprocessor.
- RFID Scanner.
- DJI Naza Software

List of Components/Software Required Software:

- Naza software
- Arduino pro software
- RFID Scanner

Drone Components

Frame: The main body of drone is used to assemble all components on it to make secure flight.

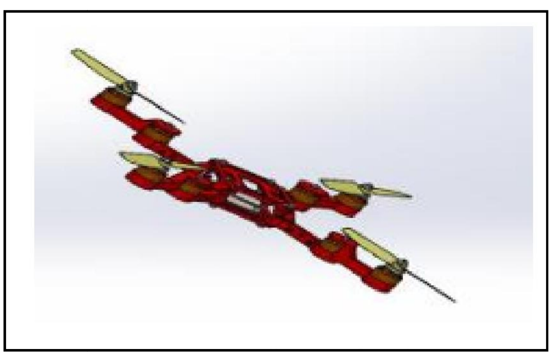

Fig -1: Drone Body

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, May 2024

Propellers: It will design to lift enough weight of drone. There are two types of propellers are used in drone clock wise and anticlockwise.

Electronic Speed Control: It consist of MOSFET circuit to control the current of each part of BLDC motor. It control the speed of motor.

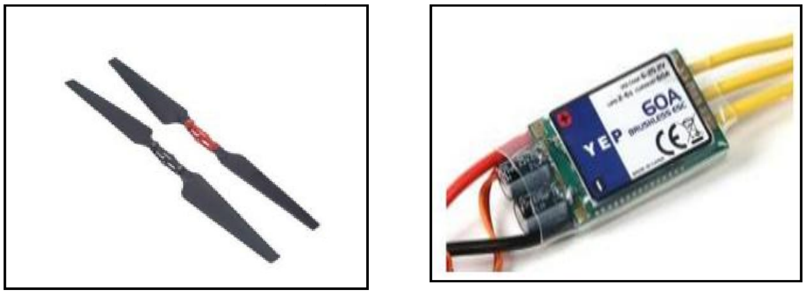

Fig -2: Propellers & ESC

Motors: We used the brushless DC motors which have the highest torque in segment to lift drone body.

Servo Motor: We used servo motor as a gimbal to control the angle of the sensor. It have the in build gears to increase.

Fig -3: Motors & Servo Motor

Flight Controller: It control's the all ESC in the drone using signal received from the ground unit. It consist of different sensors accelerometer, barometer, magnetometer, GPS, Gyroscope, etc.

LiPo battery: The battery is LiPo battery (Lithium Polymer). It have the highest current carrying capacity to provide a constant current to ESC. It is used because it has high discharge than Li-ion battery. It is more light weight than the Li-ion battery.

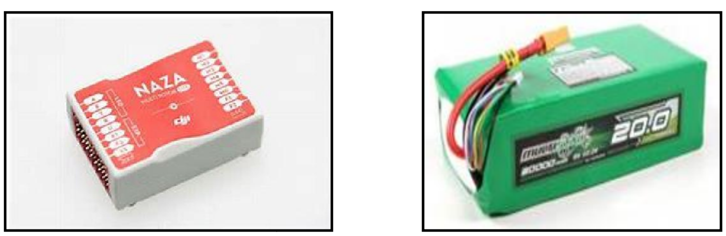

Fig -4: Controller & LiPo Battery

RFID Modem: An RFID modem is a device that enables communication between a computer or controller and RFID (Radio-Frequency Identification) tags or cards, facilitating data exchange for tracking and identification purposes.

2D scanner: The 2d scanner is used to scan the barcode of the vehicles. Each vehicle consist of a unique barcode consisting information of the owner, vehicle, address of owner, etc.

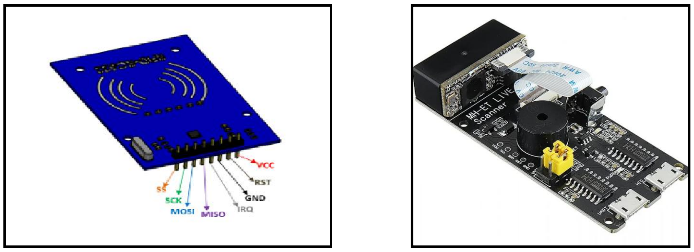

Fig -5: RFID Modem & 2D Scanner

III. SYSTEM DEVELOPMENT

Block Diagram Development of Block Diagram.

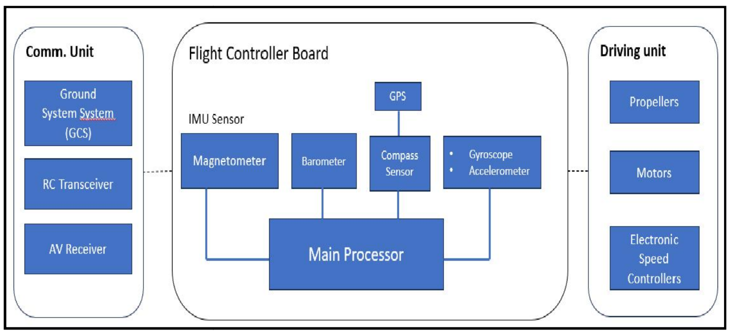

Fig -7 Block Diagram

A drone's block diagram consists of interconnected components that enable its flight and functionality. The power source, usually a battery or fuel cell, provides energy for the system. The propulsion system, comprising motors and propellers, generates thrust for lift and control.

The flight controller, equipped with sensors like gyroscopes and accelerometers, processes data to control the drone's orientation and movement. A communication system, including a radio transceiver, facilitates communication between the drone and a ground control station. The

Navigation system utilizes GPS and a compass for accurate positioning. An onboard computer

Handles additional computational tasks, while optional sensors like cameras and LiDAR contribute to specific applications.

Functional Partitioning

Sensors are mainly used in drone are as follows:

Module 1: IMU

It is essential sensor module to controlling the external sensors.it consist of a gyroscope, accelerometer, GPS, etc. are used in a drone.

Module 2: Optical flow

A CPU, a number of sensors, and a camera make up the optical flow. It uses camera to record the footage, then it compares the ensuing frames to determine the drone's attitude and speed. The on-board CPU processes the data from the several sensors utilized in this process, including the gyroscope and sonar.

Module 3: GPS

The drone's precise location is determined by the GPS module, which gets signals from satellites circling the planet. It takes more than four signals from different satellites to precisely determine the position. The well-known interference

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, May 2024

techniques for GPS modules are jamming and spoofing, and the associated research and experimental findings are also well known.

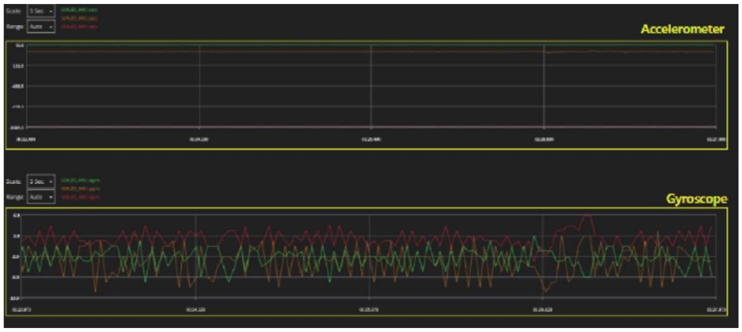

Fig -8 GPS & Accelerometer graph

Module 4: Custom Drone:
To communicate the recorded video to the receiver, the camera module of the custom drone employs a frequency modulated 5.8 GHz ISM band. We chose 5.74 GHz as the channel's center frequency for the experiment. We utilized a typical gain-horn antenna and a signal generator to jam transmissions.

Module 5: Monitoring sensor data:
When setting up an experiment to examine how a sensor module responds to external interference signals, it is helpful to use a camera or other sensor module whose response.

Flowchart

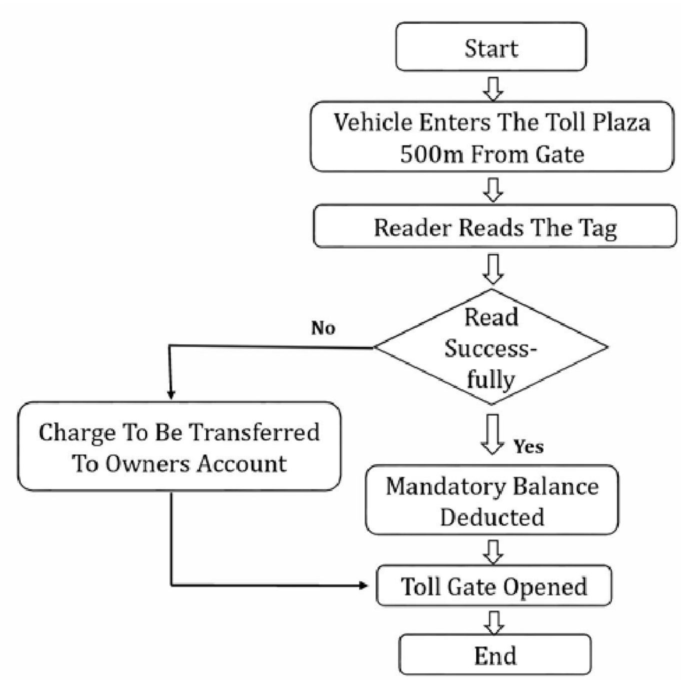

Fig -9 Flowchart

Start: The drone starts when the power button is pressed
Initialization: The flight controller initializes sensors (IMU, barometer) and checks system health.
Pre-flight Checks: The drone performs pre-flight checks, including battery status, GPS lock, and sensor calibration.

Takeoff: Upon user command (remote controller or autonomous mission), the drone takes off.

In-flight Operation: The flight controller continuously reads sensor data (gyro, accelerometer, GPS) to maintain stability.

If GPS is used, the drone follows a predefined flight path or hovers in a specified location.

User Input: The drone responds to user inputs from the remote controller for direction, altitude changes, or mission-specific commands.

Navigation: The drone uses GPS and compass data for navigation and maintaining a specified course.

Landing: The drone descends and lands either autonomously or under user control.

Post-flight Checks: After landing, the drone performs post-flight checks, including checking battery levels and system status.

Shutdown: The drone is shut down, ending its operational cycle.

End: The flow chart concludes, representing the completion of the drone's mission or flight

IV. CONCLUSION

The Fastag scanning using drones is a revolutionary solution for optimizing toll collection systems and traffic management at toll plazas. This innovative solution uses advanced RFID technology and high-resolution imaging capabilities to provide efficiency, accuracy, and real-time monitoring, addressing congestion, manual errors, and delays. The seamless integration of drone technology into existing infrastructure minimizes disruptions and maximizes benefits. The multidisciplinary approach emphasizes collaboration and specialization for successful deployment. The project's future scope extends beyond toll collection, with potential applications in data analytics for traffic management and regulatory compliance. The initiative aims for continuous improvement and adaptation to emerging technologies, setting a precedent for the evolution of transportation systems towards a smarter, more efficient, and interconnected future.

REFERENCES

[1]. Zaitseva, Elena, Vitaly Levashenko, Ravil Mukhamediev, Nicolae Brinzei, Andriy Kovalenko, and Adilkhan Symagulov. "Review of Reliability Assessment Methods of Drone Swarm (Fleet) and a New Importance Evaluation Based Method of Drone Swarm Structure Analysis." Mathematics 11, no. 11 (June 1, 2023): 2551.

[2]. Yash Soni, Akash Bangar, Pranali Ghugal, Kunal Wandhre, Nimish Munishwar, Dr N.V. Chaudhari."RESEARCH PAPER ON E-TOLL SYSTEMWITH USER AND VEHICLE IDENTIFICATION."IJARIIE-ISSN(O) Vol-4 (Issue- 2 2018)

[3]. Lu Xing, Daoxing Zou, Yi Fei, Kejun Long, and Jie Wang."Safety Evaluation of Toll Plaza Diverging Area Considering Different Vehicles Toll Collection Types." Applied Sciences Volume 13 (August 6, 2023).

[4]. Eugen Valentin Butila and Razvan Gabriel Boboc "Urban Traffic Monitoring and Analysis Using Unmanned Aerial Vehicles (UAVs): A Systematic Literature Review" Department of Automotive and Transport Engineering, Transilvania University of Brasov, RO-500036 Brasov, Romania(2022)

[5]. Marina Milenković, Nemanja Stepanović, Draženko Glavić, Vladan Tubić, Ivan Ivković, Aleksandar Trifunović. "Methodology for determining ecological benefits of advanced tolling systems." Journal of Environmental Management Volume 258, (March 15,2020),110007

[6]. Likhit V. Pandav, Tejas O. Tale, Prof. A. P. Dange. "STUDY OF DIFFERENT TECHNOLOGIES FOR DIGITAL TOLL COLLECTION SYSTEM." International Research Journal of Modernization in Engineering Technology and Science Volume: 02 (June 06, 2020).

[7]. Devika Mahtre "Electronic Toll Collection Using Barcode Reader," International Journal of Advanced Research in Computer Science and Software Engineering, ISSN: 2277 128X NCRTCC 2017, pp.001-005

[8]. Rahul Raj C. P, SeshuBabu Tolety, Catheine Immaculate, "QR code based navigation system for closed building using smart phones," Volume 6 Issue V, May 2018 IEEE.