

Title: Health Emergency Automation **AI Solution**

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Background to the AI Solution.

The idea of autonomous flying drones that deliver medical packages from healthcare facilities (i.e., Clinics, Hospitals, and Pharmacies) to people in need is more than relevant in helping the community. The community stands to gain the most from the project because it has the potential to save lives, time, and money and also improve efficiency while delivering quality medical services. While drones are a visible and tangible part of the PROJECT-Xai program, the underlying AI technologies make the system intelligent, efficient, and adaptable to challenges.



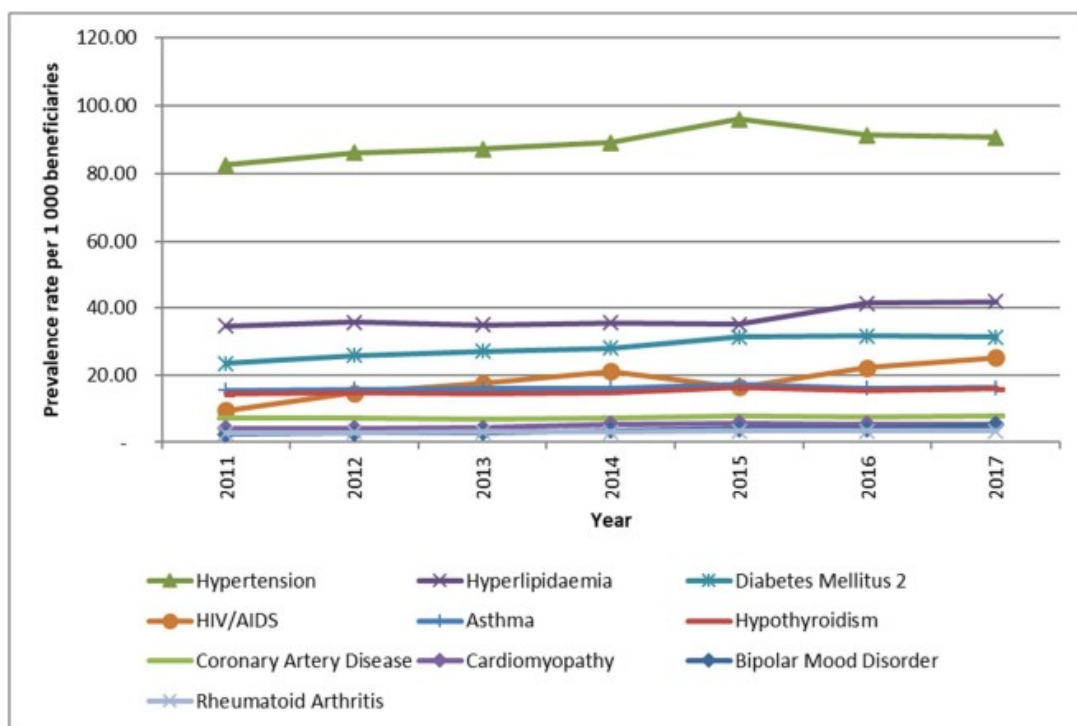
Problem Definition.

The Sedibeng community is a rural area with a population of over 1 million people. The community is underserved by healthcare, with limited access to hospitals and clinics. This is a major problem, as the community has a high incidence of chronic diseases such as HIV/AIDS, diabetes and hypertension.

Drone technology has the potential to transform healthcare in the Sedibeng community by providing access to vital medical supplies and services. Drones can be used to deliver blood, vaccines and other medical supplies to remote areas. They can also be used to transport patients to hospitals or clinics.

Forexample, drones can be used to deliver HIV/AIDS medication to patients who live in remote areas. This would help to reduce the spread of the disease and improve the health of the community. Drones can also be used to deliver insulin to diabetis, which would help to prevent complications from the disease.

The use of drone technology in healthcare is still in its early stages, but it has the potential to make a significant impact on the lives of people in underserved communities.



(an image from

<https://www.medicalschemes.com/files/Research%20Briefs/Prevalenceofchronicdiseasesinthe medicalschemes population.pdf> showing the population of the vaal population living with chronic diseases)

Benefits to local municipality.

The benefits that come with solving the problem to intergrating Drone technology with Artificial Intelligence(AI) are and not limited to:

- **Improved health outcomes:** By providing residents with access to vital medical supplies and services, drone technology can help to improve health outcomes in the community. This can lead to a reduction in the incidence of chronic diseases, such as HIV/AIDS, diabetes, and hypertension. It can also lead to a decrease in the number of people who need to be hospitalized, which can save the municipality money.
- **Reduced transportation costs:** Drones can be used to transport medical supplies and patients to hospitals and clinics, which can reduce the transportation costs for the municipality. This is especially beneficial for remote areas that are not easily accessible by road.
- **Increased efficiency:** Drones can deliver medical supplies and patients more quickly and efficiently than traditional methods, such as ground transportation. This can help to save lives in emergency situations.
- **Improved reputation:** By using drone technology to improve healthcare in the community, the municipality can improve its reputation and attract new businesses and residents.
- **Increased job creation:** The use of drone technology in healthcare can create new jobs in the community, such as drone pilots, technicians, and maintenance workers. This can help to boost the local economy.

Overall, solving the problem of limited access to healthcare in the Sedibeng community will have a number of benefits for the local municipality. These benefits include improved health outcomes, reduced transportation costs, increased efficiency, improved reputation, and increased job creation.

The main objective

The primary objective of merging drone technology and artificial intelligence(AI)within the local municipality's healthcare framework is to catalyze a revolutionary shift in medical services. By synergizing AI-operated drones, the primary goal is to reimagine healthcare delivery with a focus on accessibility, responsiveness, and efficiency through automation. This integration is set to address significant challenges by:

Overcoming Geographical Barriers: The key aim is to conquer the hurdles posed by geographical isolation. The combination of AI and drone capabilities facilitates seamless and swift delivery of essential medical supplies to remote or hard-to-reach areas. This united approach guarantees timely access to critical resources, transcending physical limitations and ensuring that even the farthest corners of the municipality receive life-saving aid promptly.

Enabling Swift and Precise Responses: The integration seeks to expedite emergency responses by empowering drones with AI-driven autonomy. This implies the ability to autonomously transport medical supplies to emergency sites,

markedly reducing response times during critical medical incidents. This objective underscores the fusion's potential to save lives through rapid and precise interventions.

Promoting Equity and Efficiency: By merging AI and drones, the overarching objective is to promote equitable healthcare access. This dynamic partnership promises to erase disparities by offering quality medical services to marginalized and remote communities. Simultaneously, the approach streamlines healthcare operations by automating supply distribution, optimizing resource allocation, and bolstering overall efficiency.

In essence, the core objective is to provide efficient, timely and equitable medical services. Though this innovative alliance, the municipality is poised to redefine healthcare delivery services, marking a transformative leap toward a future characterized by enhanced healthcare accessibility and automation.

Our Business Success Criteria.

Below is the Business Success Criteria as the specific factors that a drone infused Artificial Intelligence has to achieve to be successful from time to time:

Safety

- The drone must be able to avoid collisions with other objects, such as buildings, trees, and other drones. This can be achieved through the use of sensors, such as cameras and radar, and by using algorithms to detect and avoid obstacles.
- The drone must be equipped with safety features, such as parachutes, in case of an emergency.
- The drone must be designed to minimize the risk of injury to people and property.

Accuracy

- The drone must be able to deliver its cargo to the correct location, even in complex or challenging environments. This can be achieved through the use of sensors, such as GPS and cameras, and by using algorithms to navigate and track its location.
- The drone must be able to adapt to changes in its environment, such as wind and rain.
- The drone must be able to communicate with its operator in real time, so that the operator can provide guidance and make adjustments as needed.

Reliability

- The drone must be able to operate reliably, even in adverse conditions. This means that the drone must be well-designed and built, and it must be equipped with reliable sensors and actuators.
- The drone must be able to withstand the stresses of flight, such as turbulence and wind gusts.
- The drone must be able to operate for extended periods of time without needing to be refueled or recharged.

Efficiency

- The drone must be efficient in its use of energy and resources. This means that the drone must be designed to minimize its weight and drag, and it must be powered by a sustainable energy source.
- The drone must be able to fly for long distances on a single battery charge.
- The drone must be able to operate in a variety of weather conditions without using excessive energy.

Cost-effectiveness

- The drone must be cost-effective to operate and maintain. This means that the drone must be relatively inexpensive to purchase, and it must have low operating costs.
- The drone must be able to be easily manufactured and repaired.
- The drone must be able to use off-the-shelf components to reduce costs.

Public acceptance

- The drone must be accepted by the public. This means that the public must be comfortable with the use of drones in their airspace and communities.
- The drone must be operated in a safe and responsible manner.
- The drone must be properly insured.

By considering all of these factors, businesses can develop drone with AI systems that are likely to be successful.

Requirements.

The key requirements for a successful project that integrates AI with drone technology to transport medical supplies include:

1. Feasibility Study:

- i) Technical Feasibility: Assess whether the AI algorithms and drone technology can effectively work together to achieve the desired medical supply deliveries. Consider factors such as navigation accuracy, obstacle avoidance, and payload capacity.
- ii) Financial Feasibility: Evaluate the cost of developing, deploying, and maintaining the AI-drone system against the potential benefits, including improved healthcare access and faster deliveries.
- iii) Regulatory Feasibility: Determine if the project can adhere to aviation regulations, airspace restrictions, and medical supply transportation guidelines.

2. Design and Development:

- i) Hardware Selection: Choose drones with appropriate payload capacity, battery life, and durability for medical supply transport.
- ii) Software Development: Develop AI algorithms for route planning, real-time obstacle detection, collision avoidance, and decision-making based on medical priorities.
- iii) User Interface: Create an intuitive user interface for operators to monitor and intervene if necessary during drone operations.

3. Testing and Validation:

- i) Simulation Testing: Use simulations to test the AI-drone system's performance in various scenarios, including adverse weather conditions, urban and rural areas, and emergency situations.
- ii) Real-world Testing: Conduct field tests with actual drones to validate the system's effectiveness and reliability in real environments.

4. Regulatory Compliance:

- i) Airspace Regulations: Ensure compliance with aviation authorities' rules regarding drone flights, altitude limits, and restricted areas.
- ii) Safety Standards: Implement safety features such as redundant systems, fail-safes, and geofencing to prevent unauthorized drone flights.

5. Public Acceptance and Education:

- i) Community Engagement: Educate the public about the benefits of the project, including faster medical supply deliveries during emergencies and to remote locations.
- ii) Address Concerns: Address concerns related to noise, privacy, safety, and potential job displacement through transparent communication.

6. Operational Deployment:

- i) Emergency Protocols: Develop protocols for emergency situations, such as drone malfunctions, collisions, or adverse weather conditions.
- ii) Remote Monitoring: Implement systems for real-time monitoring of drone operations, enabling operators to intervene if necessary.

7. Monitoring and Evaluation:

- i) Performance Metrics: Define and track key performance indicators, such as delivery times, successful deliveries, and system reliability.
- ii) User Feedback: Gather feedback from medical professionals, community members, and drone operators to continuously improve the system.

8. Sustainability

- i) Maintenance: Develop a maintenance schedule for both the hardware (drones) and software (AI algorithms) to ensure their ongoing functionality.
- ii) Scalability:** Plan for potential expansion of the project to cover larger areas or accommodate increased demand for medical supplies.

A project's success is measured not only by its technical achievements but also by its impact on healthcare accessibility, safety, and public trust. By addressing the outlined requirements, a project integrating AI with drone technology for medical supply transport can effectively bridge gaps in healthcare delivery, especially in remote and disaster-affected regions.

Constraints.

Drones have technical limitations: they can't carry heavy payloads or cover long distances like planes. Their weight and costs increase with enhanced features. Safety, efficiency, and fragile cargo protection are concerns. Cold chain maintenance for drugs/vaccines requires built-in coolers. Battery life and environmental tolerance are issues, although solar-powered solutions are emerging. Return-to-base and interference responses are programmable.

- **Communication links:** Drones rely on communication links for control and data transmission. These links are vulnerable to jamming and interception, which can

compromise the drone's mission. This is a major constraint for medical deliveries, as it could prevent the drone from delivering critical supplies or medications.

- **Flight endurance and range:** Drones have limited flight endurance and range, which can restrict their use in certain missions. This is also a major constraint for medical deliveries, as it could limit the drone's ability to reach remote areas or deliver large quantities of supplies.
- **Payload capacity and versatility:** Drones are often designed for specific tasks, which limits their versatility in rapidly evolving or complex operational environments. This can be a constraint for medical deliveries, as it may be difficult to find a drone that is capable of carrying the necessary supplies and equipment.
- Data processing for drone delivery of medical supplies can be time-consuming due to the need to collect data about the surroundings, plan a safe and efficient route, avoid collisions, and secure the data. The amount of data that needs to be processed can be significant, and the processing of this data can take time. Advances in technology are making data processing faster and more efficient, which could help to overcome this constraint in the future.
- **Weather conditions:** Drones are susceptible to adverse weather conditions, which can limit their ability to fly or collect accurate data. This is a major constraint for medical deliveries, as it could prevent the drone from delivering supplies in an emergency.
- The adoption of drones for medical deliveries faces a prominent constraint in terms of the initial capital required to acquire the necessary equipment. Despite recent reductions in drone costs, advanced models suitable for medical deliveries can still command significant investments, often reaching tens of thousands of dollars. Alongside the drone itself, the endeavor demands financial resources for essential components like high-quality cameras, GPS devices, and supplementary accessories vital for accurate and secure delivery operations.
- Diverse drone models are available for medical deliveries, each varying in capabilities and associated costs. Premium models feature advanced attributes such as extended battery life, real-time monitoring systems, and advanced safety features. These functionalities ensure the safe and efficient transportation of medical supplies, but they also carry a notable price tag. For entities venturing into drone-assisted medical deliveries, a pragmatic

approach might involve starting with a mid-range model and considering upgrades as operational requirements evolve.

- Beyond the drone, there's a requirement for additional accessories and software critical for precise and secure delivery operations. These encompass GPS equipment, secure cargo containers, and specialized software for route optimization and monitoring. While these costs might appear relatively minor compared to the drone's price, they can swiftly accumulate and significantly contribute to the overall cost of implementing drone-assisted medical deliveries.
- In conclusion, the initial financial investment necessary for adopting drones in medical deliveries can present a substantial entry hurdle. However, it's vital to recognize that while the upfront expenses may be noteworthy, the potential long-term benefits in terms of streamlined medical logistics, improved response times, and enhanced patient outcomes can ultimately offset the initial costs.

In addition to these constraints, there are also ethical considerations to be taken into account when using drones for medical deliveries. For example, it is important to ensure that the drone does not violate the privacy of patients or interfere with medical care.

Despite these constraints, drones have the potential to play a significant role in medical deliveries. By overcoming these challenges, drones could be used to deliver critical supplies and medications to remote areas or in emergency situations.

Risks.

Risks of Integrating Artificial intelligence with Drone technology may include but not limited to:

- Integrating Artificial Intelligence (AI) with drone technology for transporting medical supplies can have numerous benefits, but it also presents certain risks and challenges that need to be carefully addressed. Here are some of the potential risks associated with this integration:
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- **Safety and Reliability:** Drones carrying medical supplies need to operate safely and reliably, especially in critical medical situations. AI-driven systems might encounter

unexpected glitches, hardware failures, or software errors that could compromise the safety and successful delivery of medical supplies.

- **Technical Complexity:** AI and drone technologies are complex on their own. Integrating both introduces an additional layer of complexity. This complexity can make the system harder to troubleshoot, maintain, and upgrade. It also increases the risk of unforeseen interactions between AI algorithms and drone hardware.
- **Privacy and Security:** AI-driven drones collect and transmit data to make decisions. Ensuring the privacy and security of sensitive medical data, as well as preventing unauthorized access to the drones' control systems, is crucial. Breaches in security or privacy could lead to serious consequences, including misuse of medical data or tampering with the supplies.
- **Regulatory and Legal Challenges:** The operation of drones in airspace is subject to stringent regulations to ensure public safety. Integrating AI adds another layer of complexity to regulatory approval, as regulators must assess the AI algorithms' reliability and their ability to handle diverse scenarios. Navigating these regulations while ensuring safe operations can be challenging.
- **Environmental Impact:** While drones can be more environmentally friendly than traditional delivery methods, their widespread use could still raise concerns about noise pollution, disruption to local wildlife, and the energy consumption associated with drone operations.
- **Technical Limitations:** AI algorithms, though advanced, are not infallible. They might struggle to handle unforeseen situations, complex weather conditions, or unfamiliar terrains. Medical deliveries often require real-time decision-making, and any limitations in AI capabilities could pose risks.
- **Acceptance and Public Perception.** Introducing AI-driven drones into medical supply chains might face resistance from communities due to concerns about job displacement, noise, privacy, and a general unease with new technologies.
- **Cost and Accessibility.** Developing, deploying, and maintaining AI-powered drone systems can be costly. Ensuring that these technologies are accessible to all, including underserved and remote areas that may benefit most from medical supply delivery, is a challenge.

- **Ethical Considerations.** AI algorithms might need to make decisions in situations where there's potential for harm. For example, if a drone encounters a collision risk, it might need to decide between minimizing the risk to people on the ground versus protecting the medical supplies. Balancing these ethical considerations is a significant challenge.
- **Dependency on Technology.** Relying heavily on AI-driven drones might lead to a potential loss of human skills and knowledge in traditional supply chain management, which could be problematic if there's a need to revert to non-automated systems.
- **Addressing these risks** requires a comprehensive approach that involves collaboration among technologists, regulators, medical professionals, and the general public. Thorough testing, ongoing monitoring, robust cybersecurity measures, and transparent communication about the capabilities and limitations of the technology are essential to mitigate these risks and ensure the successful integration of AI with drone technology for medical supply transport.

Tools and Techniques.

Pursuing a project that integrates AI with drone technology to transport medical supplies requires a combination of tools and techniques to ensure successful implementation. Here are some essential tools and techniques you might consider:

Certainly, here's more detailed content on the tools and techniques, along with some relevant resources that can assist in pursuing a project that integrates AI with drone technology for medical supply transport:

Tools:

1. Simulators and Emulators:

- **AirSim:** A high-fidelity simulator developed by Microsoft for testing AI algorithms in various environments, including urban and rural scenarios.

2. Programming Languages:

- **Python:** Widely used for AI development due to its extensive libraries (like TensorFlow and PyTorch) and simplicity for rapid prototyping.

3. *Development Frameworks and Libraries:*

- TensorFlow: An open-source machine learning framework that provides tools for building and training AI models.
- PyTorch: A deep learning framework that supports dynamic computation graphs, making it flexible for research and development.
- OpenCV: A library for computer vision tasks, offering tools for image and video analysis.

4. *Drone Platforms:*

- DJI Developer Tools: APIs and SDKs for integrating custom applications with DJI drones.

5. *Integrated Development Environments (IDEs):*

- Visual Studio Code: A lightweight and powerful code editor with extensions for various programming languages.
- Jupyter Notebook: An interactive environment for writing and running code, widely used for data analysis and experimentation.

6. *Geospatial Tools:*

- QGIS: A free, open-source geographic information system for viewing, editing, and analyzing geospatial data.

7. *Data Collection and Analysis Tools:*

- Adafruit Sensors: A collection of sensors for data collection, including GPS modules and accelerometers.

Techniques:

1. *Machine Learning and Deep Learning:*

- Coursera Machine Learning Course: A comprehensive introduction to machine learning by Andrew Ng on Coursera.

2. *Computer Vision:*

- OpenCV Tutorials: Official tutorials covering various computer vision tasks using OpenCV.

3. *Path Planning and Navigation Algorithms:*

- Robotics: Computational Motion Planning: A textbook providing an in-depth understanding of motion planning algorithms.

4. *Sensor Fusion:*

- Sensor Fusion and Non-linear Filtering for Automotive Applications: A book focusing on sensor fusion techniques in autonomous systems.

5. *Real-time Data Processing:*

- Real-Time Analytics: A book covering real-time data processing techniques for making informed decisions.

6. *Testing and Validation Strategies:*

- Software Testing Fundamentals: A resource providing foundational knowledge on different testing techniques.

7. *Risk Assessment and Mitigation:*

- Risk Management and Assessment: A comprehensive guide on risk management in project development.

8. *User-Centered Design:*

- Don Norman's "The Design of Everyday Things": A classic book on user-centered design principles.

Remember that this is a complex project, and continuous learning, experimentation, and adaptation are key to its success. Leveraging these tools and techniques, along with resources from reputable institutions, can significantly enhance your project's development and increase its chances of successfully integrating AI with drone technology for medical supply transport.

Poster.

PROJECT - XAI

RE-IMAGINING TRANSPORTATION OF MEDICAL SUPPLIES



WITH PANDEMICS PREDICTED TO HAPPEN MORE OFTEN, THE NEED TO RECEIVE AND SEND MEDICAL SERVICES TO THE PEOPLE WE LOVE IS A THING WE HAVE THOUGHT ABOUT OVER AND OVER AGAIN.

THE GROWING NUMBERS OF:

- THE POPULATION IN OUR COMMUNITY.
- DEASED PERSONNEL.
- CONTAGIOUS DISEASES.
- REMOTE WORK.

WITH THESE MENTIONED, THE NEED OF AUTOMATED SERVICES HAS NEVER HAD A BETTER TIME TO BE INTRODUCED IN OUR SOCIETY.

THIS IS TO HELP WITH:

- EFFICIENCY IN TRANSPORTING MEDICATION
- IT LOWERS THE COST OF GETTING A SERVICE
- IT ENSURES PRIVACY SINCE LESS PERSONNEL ARE INVOLVED.

WHAT MATTERS THE MOST IS WE SAVE LIVES.

FIND US:



1234 Vaal Triangle, Emfuleni Vanderbijlpark, Gauteng



https://github.com/PROJECT-Xai/Health_Emergency_Automation

The kind machine learning approach, Data and Model.

The integration of machine learning into the project that combines Artificial Intelligence with drone technology for medical supply transport is pivotal for achieving navigation, obstacle avoidance and decision-making. Here's an overview of the machine learning approach, considering both the data aspect and the model aspect of the project.

Data Aspect:

1. Data Collection and Preprocessing:

- Collecting a diverse dataset is essential for training models that can handle a wide range of scenarios, from urban environments to remote and challenging terrains. This dataset should encompass various weather conditions, obstacle densities, and terrain types to ensure the model's adaptability.
- Preprocessing the collected data involves cleaning noise, normalizing values, and addressing outliers. Additionally, data augmentation techniques like image rotation or translation can artificially increase the dataset's size and variability, enhancing the model's robustness.

2. Feature Engineering:

- Feature engineering involves selecting relevant information from the collected data to represent the characteristics essential for effective decision-making. Extracting features such as altitude, distance to obstacles, and GPS coordinates allows the model to comprehend its surroundings and plan accordingly.
- These features should be carefully chosen to strike a balance between providing valuable input to the model and avoiding unnecessary complexity that might hinder real-time processing.

3. Data Labeling for Supervised Learning:

- Annotating the data involves marking relevant elements within the dataset to guide the model's learning process. For medical supply transport, this could mean labeling safe landing zones, identifying obstacles, and categorizing terrain types.
- The accuracy of these annotations directly influences the model's performance. Expert knowledge and collaboration with domain professionals are crucial to ensure accurate labeling.

4. Data Splitting:

- Dividing the data into distinct sets serves different purposes in the model development cycle. The training set provides the foundation for the model's learning process, enabling it to recognize patterns and relationships.

- The validation set helps in tuning hyperparameters and preventing overfitting by assessing the model's performance on unseen data. The testing set ultimately evaluates the model's generalization and suitability for deployment in real-world scenarios.

Model Aspect:

1. *Path Planning and Navigation:*

- Path planning and navigation models aim to make the drone reach its destination efficiently while avoiding collisions and obstacles. Reinforcement Learning (RL) can train models to learn optimal paths by rewarding safe and timely deliveries.

- Alternatively, Supervised Learning (SL) can leverage labeled training data to predict suitable flight paths. These models require a solid understanding of the environment, achieved through data preprocessing and feature engineering.

2. *Obstacle Detection and Avoidance:*

- For obstacle detection and avoidance, Convolutional Neural Networks (CNNs) can learn to recognize objects in images captured by the drone's cameras. These models are trained using annotated data that includes images with and without obstacles.

- Upon deployment, the trained CNNs enable real-time detection of obstacles, allowing the drone to adjust its course or height to avoid potential collisions.

3. *Decision-Making:*

- The heart of AI-powered drones' capabilities lies in their decision-making algorithms. Reinforcement Learning (RL) models can be fine-tuned to prioritize medical supply delivery while maintaining safety standards.

- These models learn from simulation or real-world experience, determining actions that lead to favorable outcomes based on reward functions. Balancing urgency, safety, and efficiency is key in creating effective decision-making strategies.

4. *Model Fusion for Sensor Data:*

- Sensor fusion combines data from multiple sensors like GPS, cameras, accelerometers, and gyroscopes to form a comprehensive understanding of the drone's

environment. Techniques such as Kalman filters or deep fusion networks optimize the integration of data from diverse sources.

- This fusion enables the model to accurately perceive the surroundings, accounting for uncertainties and noise inherent in each sensor.

5. *Real-time Processing:*

- Real-time processing is crucial for enabling drones to respond swiftly to changing conditions. To achieve this, models might need to be optimized for faster execution without compromising accuracy.

- Model quantization, which reduces the model's memory and computation requirements, is one such technique to ensure real-time responsiveness.

6. *Continuous Learning:*

- Implementing online learning techniques ensures that the AI model remains up-to-date with evolving conditions. As the drone encounters new scenarios, it continues to refine its decision-making based on real-world experiences.

- Continuous learning helps the model adapt to unforeseen challenges and guarantees that it doesn't become obsolete over time.

7. *Model Evaluation and Iteration:*

- Evaluating the model's performance is an ongoing process. Metrics like accuracy, precision, recall, and F1-score provide insights into how well the model is fulfilling its intended tasks.

- Regular iterations involve refining the model based on evaluation results and incorporating user feedback to ensure optimal performance and usability.

By thoroughly addressing the data and model aspects using the above strategies, the project can develop a robust AI-powered drone system that navigates, avoids obstacles, and makes informed decisions effectively, ultimately contributing to the successful transportation of medical supplies in diverse and challenging scenarios.

Deep Learning

Creating a drone system for delivering medications during health emergencies is a fascinating and impactful application of AI and deep learning. Deep learning can help drones reach fully autonomous navigation by enabling them to interpret visual and other sensor data more accurately.

Deep learning approaches in computer vision applications have made significant strides towards vehicular autonomy. The ability of training deep learning models to provide robust interpretation of visual and other sensor data in drones is critical to the ability of drones to reach fully autonomous navigation. In addition, deep reinforcement learning for drone navigation using sensor data proposes a deep reinforcement learning algorithm with incremental curriculum learning to improve training and an LSTM (long short-term memory networks) recurrent layer to allow the drone to learn from past experiences.

Object Detection and Tracking:

Implementing object detection and tracking using deep learning models like YOLO (You Only Look Once) or Faster R-CNN can help the drone identify and track individuals in need of medication delivery. This technology ensures accurate targeting of recipients.

There are several techniques including:

Transfer learning, multitask learning and curriculum learning.

We'll be focusing on curriculum (sequence of training criteria) learning because it can begin learning in simulators with visual rendering and then the learned model can be fine-tuned in real-world applications.

This is beneficial to our application; it allows us to use drone simulations to bootstrap the system and progress to drone flights. Curriculum learning starts with a simple task and gradually increases the complexity of the task as learning progresses until we reach the training criterion of interest. It does not forget previously learned instances.

Weather and Environmental Data Analysis:

With this Point the deep learning can analyze weather and environmental data to determine optimal times for deliveries and ensure the safety of both the drone and recipients.

Data Privacy and Security:

With the Privacy and Security point it can assist in ensuring data privacy and security during the drone's operations by detecting unauthorized access or breaches.

Semantic Segmentation:

Semantic segmentation models, such as U-Net or DeepLab, can be used to segment different areas of the community, identifying suitable landing zones for drone deliveries and avoiding obstacles.

Route Planning and Optimization:

Deep reinforcement learning can be used to optimize drone flight paths based on factors like delivery locations, traffic, weather conditions, and battery life. This ensures efficient and safe deliveries.

Real-time Image Analysis:

Using deep learning models, the drone's camera feed can be analyzed in real time to detect emergencies, such as accidents or medical incidents, allowing for immediate response and assistance.

Automated Landing and Takeoff:

Deep learning algorithms can aid in automating the drone's landing and takeoff procedures, ensuring precise landings even in challenging environments.

Risk Assessment:

Deep learning can be used to analyze historical and real-time data to assess risks associated with different delivery locations, such as areas prone to natural disasters or high crime rates.

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