PRE-FLIGHT BATTERY CONSUMPTION MODEL FOR UAV MISSIONS

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ABSTRACT

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Keywords Unmanned Aerial Vehicle · UAV · Drone · Battery · Battery Consumption · Battery Usage · Predict

1 Introduction

As unmanned aerial vehicle (UAV) technology improves, these devices become more and more integrated into society as they allow for tasks to be easily completed by a user in a route location. For example, Amazon and other distribution companies are developing methods that use these devices to deliver packages to their users in a fast and simple manner. Aside from being able to easily deliver packages, it is possible that by replacing delivery trucks all together, the total amount of emissions could be reduced which would have an overall positive impact on the environment. This technology is not limited to the aforementioned companies, instead, it is also used by archeological sites and other sports companies to conduct surveillance missions for certain dig sites where a camera might not be the best choice, or at a football game. Another use these UAVs have are with the police force as there are often situations where it is not entirely safe to send in an officer, however, by allowing that officer to remotely control a drone, it allows him and many others to be safe.

One of the many things holding UAVs back from doing such things are the simple fact that the battery usage is not easily predictable. By having the ability to know how much battery a given drone will consume can put the user at a much higher advantage as they can now determine whether or not a certain flight mission is feasible. Going back to the previous example with Amazon, their delivery drones will not always be charged to maximum capacity, therefore, if they can see how much battery a delivery will take up, then they can determine whether or not they will need to send a different drone or replace the battery. Up until now, most UAV software can only communicate to the user how much battery is remaining in real time, and while that may be enough, in some situations—like the one mentioned previously—it is important to know how much will be consumed before the UAV leaves the ground.

While there have been some attempts at creating such a model, there has not been a successful method that results in an accurate or efficient prediction. This is partially due to drones being relatively new, having only been introduced in the past few years, and as a result, not much research has been conducted. It is from this lack of literature that many have had difficulty creating a functional model. Specifically, one of the assumptions made about these drones is that the total battery energy consumption is constant from flight-to-flight [1], however, through various data samples, this is not the

case; it is variable. This and many other assumptions make up some of the shortcomings in existing literature, that if not proven correctly, can result in a considerable setback in the UAV field.

2 Related Work

Blah blah blah blah

blah blah

3 Background

Background Info

See Section 3.

3.1 Previous Research

Previous research

Equation Example:

$$\xi_{ij}(t) = P(x_t = i, x_{t+1} = j|y, v, w; \theta) = \frac{\alpha_i(t) a_{ij}^{w_t} \beta_j(t+1) b_j^{v_{t+1}}(y_{t+1})}{\sum_{i=1}^{N} \sum_{j=1}^{N} \alpha_i(t) a_{ij}^{w_t} \beta_j(t+1) b_j^{v_{t+1}}(y_{t+1})} \tag{1}$$

Paragraph The Mentioned paragraph continues onto muliple lines it is a paragraph after all. What else do I write? I don't know

4 Methods

When you have a paragraph you can also cite it. [1] and see [2] and see [3].

And for a URL, the documentation for `natbib` may be found at

`http://mirrors.ctan.org/macros/latex/contrib/natbib/natnotes.pdf`

Of note is the command `\citet`, which produces citations appropriate for use in inline text. For example,

```
\citet{hasselmo} investigated\dots
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produces

Hasselmo, et al. (1995) investigated…

`https://www.ctan.org/pkg/booktabs`

4.1 Figures

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[1] Sample of the first footnote.

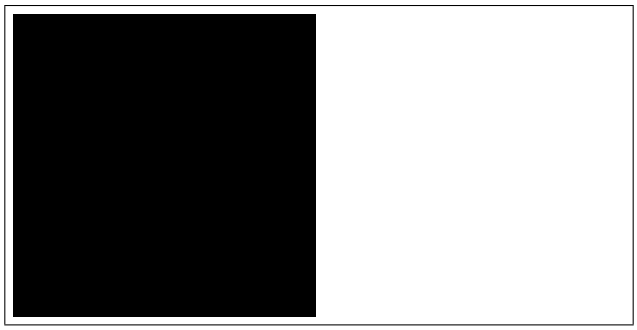

Figure 1: Sample figure caption.

Table 1: Sample table title

	Part	
Name	Description	Size (μm)
Dendrite	Input terminal	$\sim$100
Axon	Output terminal	$\sim$10
Soma	Cell body	up to 10^6

4.2 Tables

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4.3 Lists

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References

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