

## 1 Declaration

2 This report has not been submitted for any other degree at this or any other University. It is  
3 solely the work of us except where cited in the text or the Acknowledgements page. It describes  
4 work carried out by us for the capstone design project. We are aware of the university's policy  
5 on plagiarism and the associated penalties and we declare that this report is the product of our  
6 own work.

7 Student:

Date:

8 Signature:

9 Student:

Date:

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Date:

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## 13 **Abstract**

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## 21 **Acknowledgment**

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# 1 Introduction and Motivation

## 1.1 Problem statement

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## 1.2 Project significance

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## 1.3 Project objectives

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# 2 Background and Related Work

## 2.1 Background

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## 2.2 Related work

One of the essential ideas of the project is navigating and tracking the objects while minimizing the required time to detect all targets. Various methods and approaches were studied and implemented in previous research papers with different constraints and goals in mind. The methodology and algorithm in each paper was different as some of them used AI related algorithms while others relied on heavy mathematical calculations to determine the best path. In paper **hua21**, the main idea was to propose a navigation algorithm that enables each UAV to determine its own movement locally and track pedestrians (mobile targets), it focused on multiple drones to cover a specific area. **pen21** took the advantage of DRL to develop an online path planning algorithm based on double deep Q-learning network (DDQN). The constraints were to minimize the energy consumption of the UAV, the objects on the ground were not stationary and were following a Gauss-Markov movement pattern. Author **hua20** aimed to propose a reactive real-time sliding mode control algorithm to navigate a team of UAVs (UAS). The area was divided into multiple sub-areas using the Voronoi partitioning technique, each drone was responsible for a sub-area, he implemented his ideas for both types of targets, stationary targets and mobile.

All the mentioned papers presented their solutions using different simulation software. However, none of them was implemented in the real-world which questions the reliability of the algorithms.

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## 3 Requirements Analysis

### 3.1 Functional requirements

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### 3.2 Design constraints

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### 3.3 Design standards

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### 3.4 Professional code of ethics

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### 3.5 Assumptions

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## 4 Proposed Solution

### 4.1 Solution overview

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## 182 **4.2 High level architecture**

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## 190 **4.3 Hardware/software to be used**

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## 198 **5 Proof of Concept**

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## 206 **6 Market Research and Business Viability**

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## 7 Project Plan

### 7.1 Project milestones

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### 7.2 Project timeline

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### 7.3 Anticipated risks

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## 8 Short Guide

Please read the guides available online about the right way to write L<sup>A</sup>T<sub>E</sub>X such as how to include a math symbol in text (e.g.  $x$  not x) and a proper noun with all capitals (e.g. SQL not SQL).

Below are examples of different constructs in a report. You can copy-paste and change the content. For more information, refer to the relevant package manual in CTAN.



Figure 1: The arch linux logo

## 244 8.1 Figure

## 245 8.2 Equations

$$E_p = mgh = mg(x_f - x_i) \quad (1)$$

$$E_k = E_t + E_r$$

$$E_t = \frac{1}{2}mv^2 \quad (2)$$

$$E_r = \frac{1}{2}I\omega^2 \quad (3)$$

$$I = \frac{1}{2}MR^2 \quad (4)$$

$$\omega = \frac{v}{r}$$

$$E_k = \frac{1}{2}mv^2 + \frac{1}{2}I\left(\frac{v}{r}\right)^2 \quad (5)$$

246 where  $E_p$  is the potential energy,  $E_k$  the kinetic energy,  $E_t$  the translational energy and  $E_r$  the  
247 rotational energy.

$$\begin{aligned} \frac{\partial E_p}{\partial m} &= \frac{\partial}{\partial m}(mgh) \\ &= gh \end{aligned}$$

$$\begin{aligned} \frac{\partial E_p}{\partial g} &= \frac{\partial}{\partial g}(mgh) \\ &= mh \end{aligned}$$

$$\begin{aligned} \frac{\partial E_p}{\partial h} &= \frac{\partial}{\partial h}(mgh) \\ &= mg \end{aligned}$$

248 **8.3 Simple table**

Table 1: Slope, intercept and their uncertainties

Slope		Intercept (J)	
Value	Error	Value	Error
1.0933	0.0300	0.0148	0.0157

249 **8.4 Table from a csv file**

Table 2: Translational and rotational energies.

$m$	$v_m$	$E_t$	$\delta E_t$	$E_r$	$\delta E_r$
kg	$\text{m s}^{-1}$	J	J	J	J
0.055	0.17	0.000 79	0.000 01	0.280	0.007
0.075	0.20	0.001 50	0.000 02	0.387	0.010
0.095	0.23	0.002 51	0.000 03	0.512	0.013
0.115	0.25	0.003 59	0.000 03	0.605	0.015
0.135	0.27	0.004 92	0.000 04	0.706	0.018

## 250 8.5 Graph from a csv file

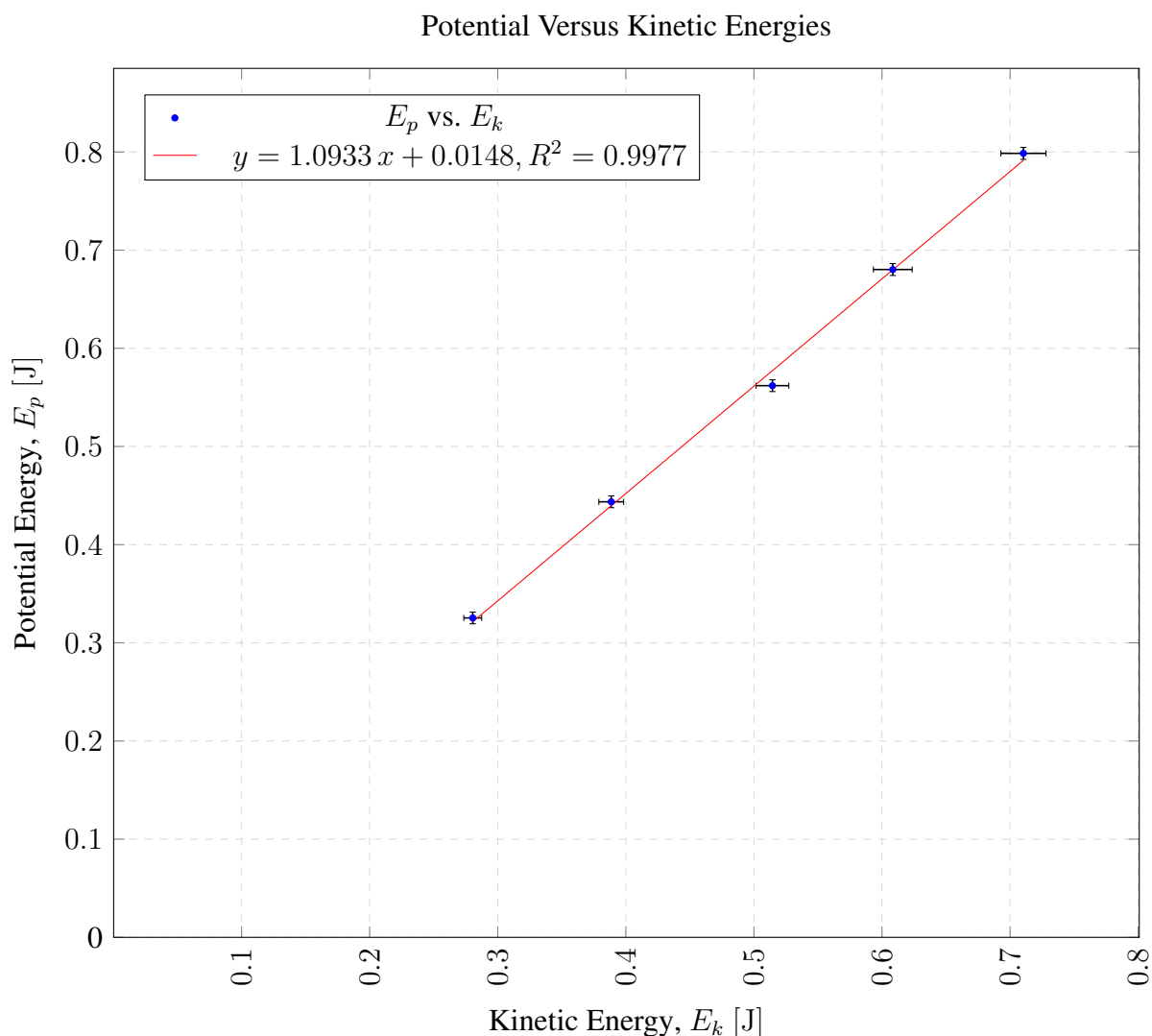


Figure 2: The relationship between potential and kinetic energies.

## 251 8.6 Citations

- 252 • **in-text citation:** use `\cite{dirac}` to produce **dirac** or `\textcite{dirac}` to  
 253 produce **dirac**
- 254 • **citation in parentheses:** `\parencite{knuthwebsite}` produces [knuthwebsite]  
 255 (for IEEE, this has no difference to the `\cite{}` command above.)

## 256 8.7 Cross-references

257 Label using suitable names with the following format: figure `\label{fig:<name>}`, tables  
 258 `\label{tab:<name>}`, sections `\label{sec:<name>}` and equations

259 `\label{eq:<name>}`.

260     **Then when cross-referencing, use `\cref{<type>:<name>}`**

261 **(or `\Cref{<type>:<name>}` when used at the beginning of a sentence)**

## 262 Appendix

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