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**CCT College Dublin Continuous Assessment**

| **Programme Title:** | Higher Diploma in Data Analytics for Business / Higher Diploma in AI Apps | | |
| --- | --- | --- | --- |
| **Delivery Mode:** | Online | | |
| **Cohort Details:** | Higher Diploma Data Analytics Sep2024 PT Semester 1  Higher Diploma AI Sep2024 PT Semester 1 | | |
| **Module Title(s)**: | Strategic Thinking | | |
| **Assignment Type:** | Individual | **Weighting(s):** | 20 % |
| **Assignment Title:** | CA 1 – Capstone Project Proposal | | |
| **Lecturer(s)**: | James Garza ([james@cct.ie](mailto:james@cct.ie)) | | |
| **Issue Date:** |  | | |
| **Submission Deadline Date:** | Sunday, 27th October 2024 23:59 | | |
| **Late Submission Penalty:** | Late submissions will be accepted up to **5** calendar days after the deadline. All late submissions are subject to a penalty of **10%** of the mark awarded.  Submissions received more than 5 calendar days after the deadline above **will not** be accepted and a mark of 0% will be awarded. | | |
| **Method of Submission:** | **This assignment is submitted via Moodle.** | | |
| **Instructions for Submission:** | Your work must be uploaded to Moodle.  • Capstone Project Proposal in Word format ONLY. The word count is 1,000.  • Ethics form signed by all students and submitted as PDF.  • ZIP or RAR files will not be accepted. Files must be submitted separately. | | |
| **Feedback Method:** | **Results posted in Moodle gradebook** | | |
| **Feedback Date:** |  | | |

**Student name: Yuri Braga**

**Student number: sba24328**

**Vehicle life cycle cost prediction tool**

**Introduction**

According to the union of concerned scientists *(Reichmuth, Dunn and Anair, 2022)*, consumers are more aware about the benefits of electric vehicles, such as reduced greenhouse gas emissions and improved air quality *(UCS,2020)*. However, they may find it hard to balance environmental benefits against financial considerations as a lack of tools that help to provide visibility of total cost of ownership (TCO) analysis.

Some key factors like insurance costs, depreciation value, maintenance, fuel consumption and others, have a direct influence in determining the total cost of ownership(TCO) over time.

While some tools like The Edmunds Inc. True Cost to Own® (TCO®) pricing system calculates the additional costs users might not consider when buying a vehicle *(Edmunds, n.d.)*, this research could not find that feature as a web service that can be easily integrated with online marketplaces and in addition to this limitation, the calculator does not promote the usage of electric vehicles to combat climate change.

Similarly, other tools like a repair cost calculator offered by AAA *(www.aaa.com, n.d.)* provide visibility over maintenance costs but it limits the user with a feature that can be incorporated with this capstone project.

This lack of an accessible, easy to integrate and easy to understand TCO analysis that encourages EV adoption, presents a clear barrier for end users looking to make informed financial and environmental decisions.

This project aims to deliver a web-based vehicle life cost prediction tool to provide predicted TCO results, promote EVs by displaying fuel types comparison , assist end users with financial decisions and promote business value.

**Problem Definition**

When buying a vehicle, consumers might encounter difficulties to predict the long-term costs associated with vehicle ownership. The following questions become difficult to answer:

**New vehicles vs Second-hand:**

Should I buy a new vehicle or a second hand one ?

**Which fuel type to choose:**

Considering fuel costs, would it be better to buy an electric or petrol?

**Long-term costs:**

How much would it cost me in the long term to choose a petrol over an electric?

**Infrastructure:**

Is my country or the city I live in prepared for electric vehicles?

**Additional Investments:**

How much would it cost to invest in an electric home plug in addition to buying an electric vehicle?

While researching online, it was identified the lack of one prediction tool that could help to solve all the above questions at once integrated with a marketplace while buying a vehicle online.

**Objectives**

1 - Deliver a web tool that can be easily accessed by any end user using a browser, that calculates and predicts the TCO (total cost of ownership), providing a solid dashboard and helping customers with the long-term financial responsibility of their decisions.

2 - Provide a personalised TCO report, empowering the end user with valuable information, collaborating with more informed decisions.

3 - Encourage the adoption of EV vehicles by displaying the long-term benefits but without biasing information.

4 - Increase business value by promoting the tool, increasing online marketplace engagement and lead conversion.

**Impact**

**Buyers:**

Without the proper visualization of TCO, buyers would make uninformed decisions, which leads towards higher expenses over time and consequently dissatisfaction with their purchase.

**Environmental Goals:**

While not certain about the benefits and costs of EVs, users would take longer to consider its adoption. This directly impacts on the world goal to reduce carbon emissions and combat climate change.

**Sales:**

Business lacks chances to engage customers with a valuable decision tool that can lead to more sales conversions and user satisfaction.

**Social:**

In a world where informed decisions are crucial to continue reducing fossil fuels, the lack of prediction tools like this one directly impacts environmental sustainability.

**Project Scope**

**Included in the Project**

* **Data collection and analysis**

Project would gather data on the following fields:

Vehicle purchase prices, insurance rate, depreciation rate, Repair and maintenance costs, fuel type costs, infrastructure for electric vehicles, government incentives and tax implications, financing incentives on green vehicles.

* **Predictive Models**

Project would develop machine learning models to help forecast the following:

Depreciation metrics, maintenance costs, fuel consumption costs, insurance costs over time.

By using algorithms such as linear regression, time-series forecasting and decision trees.

* **Web Interface**

Web-component that can be easily integrated on dealership websites

Usage of modern web technologies such as Vue, Typescript and Tailwind to build a scalable SDK that can expose the web-component tool.

* **Features**

Comparison table: A table that compares one option over the other.

Summary Dashboard: A metric dashboard component that displays TCO information over years.

**Excluded from the Project**

* **Mobile Application Development**: This tool would initially be a web only tool, meaning it will not extend to native mobile app development.
* **Real-time inventory integration:** This tool initially would not be connected with any dealership inventory. Placeholder data will be used to demonstrate its initial purpose and features.

**Methodology**

* **Project Management**: Agile methodologies with sprint cycles of 2 weeks. Jira for task control and roadmap.
* **Data collection on the following topics**: Vehicle Pricing; Vehicle depreciation; Maintenance cost; Insurance price; Financing terms; Fuel and electricity costs; EV infrastructure, Tax and incentives;Environment health; Permissions.
* **Model development**: Data processing, algorithm selection, training and validation.
* Web development: Develop the interface in VueJs and Javascript. Create a web-component SDK.
* **Backend**: Implement server to connect with the LLM service and provide the api to the front-end SDK.

**Required Data Sources**

Ideally to deliver the above functionality, at least 9 vehicle related data sources are required to achieve the full tool capability.

List of required data source, possible sources, usage permission:

**1 - Vehicle Pricing:**

New and second-hand vehicle price data. :

SIMI

Accessible in here:

<https://www.simi.ie/en/motorstats/recommended-price-guide>

ECB

Accessible in here:

https://data.ecb.europa.eu/data/concepts/second-hand-vehicles?tags\_array%5B0%5D=Second-hand%20vehicles&filterSequence=tags\_array

**2 - Depreciation**

Vehicle depreciation rates data.

Kaggle

Accessible in here:

<https://www.kaggle.com/code/alexandersylvester/used-cars-eda-with-depreciation-analysis>

https://www.kaggle.com/datasets/taeefnajib/used-car-price-prediction-dataset

**3 - Maintenance**

Maintenance costs data.

AAA

Accessible in here:

<https://www.bankrate.com/loans/auto-loans/average-car-maintenance-costs/>

https://www.theaa.ie/motoring-advice/cost-of-motoring/

**4 - Insurance**

Average insurance costs data.

Chill

Accessible in here:

<https://www.chill.ie/blog/car-insurance-pricing-index/>

**5 - Financing**

Interest rates and financing terms data

Accessible in here: :Statista (<https://www.statista.com/statistics/290673/auto-loan-rates-usa/>)

Investopedia

https://www.investopedia.com/articles/personal-finance/061615/how-interest-rates-work-car-loans.asp

**6 - Fuel type cost**

Fuel prices and EV rates data.

Accessible in here: : https://www.gulfoilltd.com/exploring-ev-and-petrol-running-costs-across-nations

**7 - EV national Infrastructure**

Locations of national EV stations

Accessible in here: : https://www.electromaps.com/en/charging-stations/ireland/county-dublin/dublin

**8 - Government Grants and Tax**

Information on tax relief and credits for EV vehicles.

Citizen Information

Accessible in here: (https://www.citizensinformation.ie)

Revenue

Accessible in here:

<https://www.revenue.ie/en/vrt/calculating-vrt/electric-hybrid-vehicles.aspx>

Windsor

Accessible in here:

https://www.windsor.ie/news/ev-tax-benefits-bik-aca/

**9 - Environmental Impact**

Carbon emissions and Co2 emission data

TCE

Accessible in here :

https://www.transportenvironment.org/articles/how-clean-are-electric-cars?gad\_source=1&gclid=CjwKCAjwx4O4BhAnEiwA42SbVEw1-qisvuTCyQbGoXXqrc8ZXXqIm16eGbJVyQgy4BdOXrhS-P-HKhoCsj8QAvD\_BwE

**Ethical Considerations**

As the project intends to collect user data to provide a more personalised dashboard, it is important to comply with the current laws and collect only the necessary data avoiding as much as possible sensitive and private data collection.

It is crucial to present the user with terms and privacy consent that outlines the purpose of the data collection, time the data will be held, and the responsibilities around data protection .

Below are some key ethical considerations which should be carry over the project implementation:

**Societal Impact**

While considering environmental benefits by promoting electric vehicles, promote unbiased comparisons so customers can make informed and personal decisions on their own circustances.

Finally ensure the tool is compliant with the current lows, not crossing lines and boundaries when it comes to user rights and advertising.

**Bias in Predictive Modeling**

While training the models, the usage of diverse and representative datasets to minimize biases related to geography and demographics. Implement regular testing against any kind of discriminatory outcomes and adjust algorithms to have a fair result.

### High-Level Timeline

| **Semester One** | **Weeks** | **Activities** |
| --- | --- | --- |
|  | Weeks 1–2 | Project initiation, requirement gathering, planning. |
|  | Weeks 3–5 | Data acquisition, permissions, preliminary analysis. |
|  | Weeks 6–8 | Model development (Phase 1) – initial predictive models. |
|  | Weeks 9–11 | Web interface prototype development. |
|  | Weeks 12–13 | Integration of models with the web interface. |
|  | Week 14 | Mid-project review, adjustments. |
| **Semester Two** | **Weeks 1–3** | **Advanced model refinement, validation.** |
|  | Weeks 4–6 | Web interface enhancement, feature implementation. |
|  | Weeks 7–8 | User testing, feedback collection. |
|  | Weeks 9–10 | Final adjustments based on feedback. |
|  | Weeks 11–12 | Comprehensive testing, quality assurance. |
|  | Weeks 13–14 | Project finalization, documentation, presentation preparation. |

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# Reference list

- Hausfather, Z. (2019). *Factcheck: How Electric Vehicles Help to Tackle Climate Change*. [online] Carbon Brief. Available at: https://www.carbonbrief.org/factcheck-how-electric-vehicles-help-to-tackle-climate-change/.

RedClick Insurance. (2020). *The Cost of Owning a Car in Ireland*. [online] Available at: https://www.redclick.ie/content-hub/cost-owning-car-ireland [Accessed 7 Oct. 2024].

Reichmuth, D., Dunn, J. and Anair, D. (2022). *Driving Cleaner Electric Cars and Pickups Beat Gasoline on Lifetime Global Warming Emissions*. [online] Available at: <https://www.ucsusa.org/sites/default/files/2022-09/driving-cleaner-report.pdf>.

Edmunds. (n.d.). *Cost of Car Ownership - 5-Year Cost Calculator | Edmunds.com*. [online] Available at: https://www.edmunds.com/tco.html.

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Further details of the assessment:

**https://github.com/bragayuri/strategic-thinking-ca-1**

1. **Support your analysis with references and properly reference ALL sources that you have used. WARNING – If you do not support your work, you will not receive a high mark!**
2. WORD COUNT: 1,000 words. You may lose up to 10% of marks if your report is too short or long!

## Assessment Requirements

All assessment submissions must meet the following minimum requirements:

* Be submitted in the format outlined in the assignment summary table.
* Ethics form signed by all students and submitted as PDF.
* ZIP or RAR files will not be accepted. Files must be submitted separately.
* Capstone Project proposal report in Word ONLY format of about 1,000 words
* Be submitted by the deadline date specified or be subject to late submission penalties.
* Be submitted via Moodle upload.
* Use [Harvard Referencing](http://40.115.124.2/sp/subjects/guide.php?subject=harvardref) when citing third party material.
* Be the student’s own work. Done
* Include the CCT assessment cover page. Done

## Grading Criteria

This grading rubric sets out the marking criteria for your assignment.

| **Criteria** | ***Project Proposal*** | ***Scope and Methodology*** | ***Data and Ethical Considerations*** |
| --- | --- | --- | --- |
| **Weighting per criteria** | **40%** | **40%** | **20%** |
| *Excellent (+70%)* | Clear, well-structured overview with clear, concise objectives and a well-explained problem definition. | Scope and methodology are very well-defined, with appropriate methods and detailed timelines for each stage. | Excellent identification and explanation of data sources. Ethical considerations are thoroughly addressed. |
| *Very Good (60 - 69%)* | Good overview with clearly stated objectives and mostly well-explained problem definition. | The scope and methodology are well-defined, but minor details are missing. The timeline effectively covers all main tasks. | Data sources are identified with some explanation; ethical considerations are adequately addressed. |
| *Good (50 - 59%)* | The overview and objectives are clear but lacking in detail. The problem definition may be vague. | Scope and methods are sufficiently defined but lack depth or detail. The timeline covers most tasks. | Data sources are listed with a basic explanation. Ethical concerns are briefly mentioned but not fully explored. |
| *Acceptable (40 - 49%)* | Objectives and problem definitions are present but underdeveloped and lack clarity. | Scope and methods are minimally addressed. The timeline is incomplete or lacks important details. | Data sources are vaguely mentioned. Ethical considerations are minimal and need more depth. |
| *Fail (< 39%)* | Little to no explanation of objectives or problem definition. | The scope and methodology are unclear or missing. No clear timeline. | Data sources and ethical considerations are either missing or not addressed at all. |