Product Requirements Document

Vehicle Pricing Estimation Tool

Purpose

The purpose of this document is to define the requirements for the development of a Vehicle Pricing Estimation Tool. The tool will initially be an Excel-based solution for testing and validation, with a future transition to a web-based application. It will predict the selling price of a vehicle based on historical auction data, excluding outliers, and provide a statistical confidence level.

Scope

* Develop an Excel-based tool for initial testing.
* Utilize historical vehicle sales data to forecast selling prices.
* Allow input through VIN (first 8 characters) or manual data entry.
* Automatically refresh data weekly and archive outdated information.
* Generate exportable reports containing price predictions and confidence levels.

**Features**

Data Management

Data Import:

* Accept Excel files with a predetermined structure.
* Append new weekly data to the master dataset.
* Automatically archive data older than 60 days. a separate file.

Data Filtering:

* Default filter to use the last 60 days of data.
* Configurable number of days, adjustable in a designated cell in the Excel tool.
* Outlier Removal: Exclude records with selling prices that are more than 3 standard deviations from the mean.

Input Methods

VIN Input:

* Match the first 8 characters of the VIN.
* Return closest matches based on vehicle attributes.

Manual Input:

Mandatory fields: In the form of drop-downs (drop should be created by the available data points in the data)

* Year
* Make
* Model
* Drivetrain
  + 4-wheel drive
  + 4-whl steer 4x2
  + 4x4 2/front whl drive
  + 4x4 w/ rear wheel drv
  + All wheel Drv
  + Four by Four
  + Front-wheel drive
  + Parttime 4 whl Drive
  + Rear-wheel drive
* Body Style
* Engine Size
* Vehicle Operating Condition
  + Drives
  + Starts
  + Non-Starts
  + Unknown
* Transmission Type
* Fuel Type
  + Gas
  + Diesel
  + Electric
  + Other
* Title Type
  + Clean
  + Salvage
  + Unknow
* Primary Damage
  + ALL OVER
  + BIOHAZARD/CHEMICAL
  + BURN - ENGINE
  + BURN - INTERIOR
  + BURN
  + FRONT END
  + HAIL
  + MECHANICAL
  + MINOR DENT/SCRATCHES
  + NORMAL WEAR
  + REJECT REPAIR
  + ROLLOVER
  + REAR END
  + SIDE
  + STRIPPED
  + TOP/ROOF
  + UNDERCARRIAGE
  + VANDALISM
  + WATER/FLOOD
* Secondary Damage
* Miles
* Location

Fallback:

If VIN matching fails or has insufficient matches, prompt for manual input.

Prediction Model

* Once the matches are identified
  + Determine the mean
  + Remove any samples that more than 3(configurable) points away from the mean
  + Predicted price using KNN (nearest known
  + Confidence level Use the standard deviation of the neighbors
    - Narrow interval = higher confidence
    - Large spread among neighbors = lower confidence
  + Adjust price based on confidence level.
  + Key data points to match on
    - Year
    - Make
    - Model
    - Engine Size
    - Miles
* Future - Use an advanced machine learning model to predict vehicle price.
* Train the model on the filtered, outlier-free dataset.

**Output**

* Predicted Price: Display the estimated selling price.
* Confidence Level: Provide statistical confidence intervals.
* Match Summary: Show the number of matching records found.
* Export: Enable export of the prediction result to a new Excel tab or separate file.

**User Interface**

Excel Template:

* Upload button for new data.
* Configurable cell for adjusting the number of days.Input fields for manual entry.
* Output section for displaying predicted price and confidence level.
* Export button to save the prediction results.

**Data Sources**

Weekly vehicle auction data with consistent structure.

Key Columns:

Lot Year, Make, Model, Drivetrain, Body Style, Engine Size, Operating Condition, Transmission Type, Fuel Type, Title Type, Primary Damage, Secondary Damage, Miles, Location, Selling Price, Attempts to Sell

**Constraints**

Initial tool must operate entirely within Excel.

Future versions must be web-based with scalable data handling.

**Excel Tool Architecture**

Sheets Layout

Data Sheet:

* Raw uploaded and appended data.
* Automatic timestamping of uploads.

Archive Sheet:

* Archived records older than the configurable number of days.

Input Sheet:

* VIN input field.
* Manual input fields for all mandatory data points.

Prediction Sheet:

* Display YMM
* Output display for predicted price.
* Statistical confidence level.

Match summary.

Configuration Sheet:

* Number of days setting.

Macros and VBA Scripts

Upload Macro:

* Append new data.
* Move old data to Archive.

Prediction Macro:

* Trigger model prediction based on input.

Export Macro:

* Save prediction results to a new tab or external file.

Machine Learning Integration

Export filtered data to a temporary CSV.

* Use a Python script (via the Excel plugin or manual run) to
* • Train the model on the current dataset.
* • Predict the price based on the input.
* • Return the prediction and confidence intervals back to Excel.

User Stories and Acceptance Criteria

Data Upload

User Story: As a user, I want to upload new vehicle data weekly so that the model remains up to date.

Acceptance Criteria:

The user can upload an Excel/CSV file.

The system appends new data and archives data older than 60 days.

VIN-Based Pricing

User Story: As a user, I want to input a VIN and get a price estimate.

Acceptance Criteria:

* The system matches the first eight characters of the VIN. • System predicts price and provides confidence interval.

Manual Input Pricing

* User Story: As a user, I want to manually input vehicle attributes if the VIN is not available.
* • Acceptance Criteria:
* • All mandatory fields must be filled out.
* • The system predicts the price and provides a confidence interval.

Data Filtering

* User Story: As a user, I want the system to use only the most recent data.

Acceptance Criteria:

* Default to last 60 days.
* Configurable in the settings panel.

Outlier Handling

* User Story: As a user, I want outliers to be automatically removed.

Acceptance Criteria:

* Selling prices >3 standard deviations are excluded from model training.

Export Prediction

* User Story: As a user, I want to export the prediction results.

Acceptance Criteria:

* The user can export results to a new tab or an external file.

Future Enhancements

* Integrate with VIN decoding services.
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* Enhance prediction models with additional features, such as market trends.
* Mobile app version.
* Enhance prediction models with additional features (e.g., market trends).

Timeline

* Phase 1: Excel Tool Development - [Insert Date]
* Phase 2: User Testing and Feedback - [Insert Date]
* Phase 3: Web Tool Development - [Insert Date]