In [32]:
```
# Created by: Michael Cullen
# 19/11/2024
# https://zenodo.org/records/10457828
# https://www.kaggle.com/datasets/syedanwarafridi/vehicle-sales-data/data
```

In [33]:
```
import pandas as pd
from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import train_test_split
import matplotlib.pyplot as plt
from sklearn.metrics import mean_squared_error, r2_score
```

In [34]:
```
# made by chatgpt to install csv as file is to big to commit to github

import kagglehub
import shutil
import os

# Define the current working directory
current_directory = os.getcwd()

# Check if the CSV file already exists in the current directory
csv_exists = any(file.endswith(".csv") for file in os.listdir(current_directory))

if not csv_exists:
    # Download the dataset using kagglehub
    default_path = kagglehub.dataset_download("syedanwarafridi/vehicle-sales-data")

    # Move all downloaded CSV files to the current directory
    for file_name in os.listdir(default_path):
        if file_name.endswith(".csv"):
            shutil.move(os.path.join(default_path, file_name), os.path.join(current

    # Delete the downloaded folder after moving the files
    shutil.rmtree(default_path)

    print("Dataset files moved to:", current_directory)
    print(f"Deleted temporary folder: {default_path}")
else:
    print("CSV file already exists in the current directory.")
```

```
CSV file already exists in the current directory.
```

In [35]:
```
df = pd.read_csv('car_prices.csv')

df.head()
```

Out[35]:

	year	make	model	trim	body	transmission	vin	state	condition
0	2015	Kia	Sorento	LX	SUV	automatic	5xyktca69fg566472	ca	5.0
1	2015	Kia	Sorento	LX	SUV	automatic	5xyktca69fg561319	ca	5.0
2	2014	BMW	3 Series	328i SULEV	Sedan	automatic	wba3c1c51ek116351	ca	45.0
3	2015	Volvo	S60	T5	Sedan	automatic	yv1612tb4f1310987	ca	41.0
4	2014	BMW	6 Series Gran Coupe	650i	Sedan	automatic	wba6b2c57ed129731	ca	43.0

In [36]:
```
print("Amount of columns: ", df.shape[0])
```

```
Amount of columns:  558837
```

In [37]:
```
df.isnull().sum()
```

Out[37]:
```
year              0
make          10301
model         10399
trim          10651
body          13195
transmission  65352
vin               4
state             0
condition     11820
odometer         94
color           749
interior        749
seller            0
mmr              38
sellingprice     12
saledate         12
dtype: int64
```

In [38]:
```
# Drop not needed columns
df = df.drop(columns=['trim','vin','state','interior','seller','saledate','mmr'], e



# Remove rows with missing data
df = df.dropna()


df.head(20)
```

Out[38]:

	year	make	model	body	transmission	condition	odometer	color	selling
0	2015	Kia	Sorento	SUV	automatic	5.0	16639.0	white	21
1	2015	Kia	Sorento	SUV	automatic	5.0	9393.0	white	21
2	2014	BMW	3 Series	Sedan	automatic	45.0	1331.0	gray	30
3	2015	Volvo	S60	Sedan	automatic	41.0	14282.0	white	27
4	2014	BMW	6 Series Gran Coupe	Sedan	automatic	43.0	2641.0	gray	67
5	2015	Nissan	Altima	Sedan	automatic	1.0	5554.0	gray	10
6	2014	BMW	M5	Sedan	automatic	34.0	14943.0	black	65
7	2014	Chevrolet	Cruze	Sedan	automatic	2.0	28617.0	black	9
8	2014	Audi	A4	Sedan	automatic	42.0	9557.0	white	32
9	2014	Chevrolet	Camaro	Convertible	automatic	3.0	4809.0	red	17
10	2014	Audi	A6	Sedan	automatic	48.0	14414.0	black	49
11	2015	Kia	Optima	Sedan	automatic	48.0	2034.0	red	17
12	2015	Ford	Fusion	Sedan	automatic	2.0	5559.0	white	12
13	2015	Kia	Sorento	SUV	automatic	5.0	14634.0	silver	21
15	2015	Nissan	Altima	Sedan	automatic	2.0	11398.0	black	14
17	2014	Audi	Q5	SUV	automatic	49.0	7983.0	white	40
18	2014	Chevrolet	Camaro	Coupe	automatic	17.0	13441.0	black	17
19	2014	BMW	6 Series	Convertible	automatic	34.0	8819.0	black	67
20	2015	Chevrolet	Impala	Sedan	automatic	19.0	14538.0	silver	7
21	2014	BMW	5 Series	Sedan	automatic	29.0	25969.0	black	30

In [39]:
```
print(df.isnull().sum())
print("Amount of columns: ", df.shape[0])
```

```
year            0
make            0
model           0
body            0
transmission    0
condition       0
odometer        0
color           0
sellingprice    0
dtype: int64
Amount of columns:  472325
```

In [40]:

```python
from sklearn.preprocessing import LabelEncoder

# Convert odometer and year to numeric
df['odometer'] = pd.to_numeric(df['odometer'], errors='coerce')
df['year'] = pd.to_numeric(df['year'], errors='coerce')

# Define the function to categorise odometer values
def categorise_odometer(odometer):  # 1 = 0-20k, 2 = 20-50k, 3 = 50-100k, 4 = 100-1
    if odometer <= 20000:
        return 1  # 0-20k
    elif odometer <= 50000:
        return 2  # 20-50k
    elif odometer <= 100000:
        return 3  # 50-100k
    elif odometer <= 150000:
        return 4  # 100-150k
    elif odometer <= 200000:
        return 5  # 150-200k
    else:
        return 6  # 200k+

# Define function to categorise year
def categorise_year(year):  # 1 = very old, 2 = old, 3 = modern, 4 = new
    if year < 1990:
        return 1  # Very old
    elif year < 2005:
        return 2  # Old
    elif year < 2015:
        return 3  # Modern
    else:
        return 4  # New

# Define function to categorise price
def categorise_price(price):  # 1 = low, 2 = medium, 3 = high, 4 = premium
    if price < 5000:
        return 1  # Low
    elif price < 20000:
        return 2  # Medium
    elif price < 40000:
        return 3  # High
    else:
        return 4  # Premium
```

```
# Apply categorisation functions
df['odometer_group'] = df['odometer'].apply(categorise_odometer)
df['year_group'] = df['year'].apply(categorise_year)
df['price_group'] = df['sellingprice'].apply(categorise_price)

# Group rare colors into 'Other' to reduce noise
if 'color' in df.columns:
    color_counts = df['color'].value_counts()
    rare_colors = color_counts[color_counts < 50].index  # Adjust threshold as need
    df['color'] = df['color'].replace(rare_colors, 'Other')

# Handle categorical features using LabelEncoder
categorical_columns = ['make', 'model', 'body', 'cylinders', 'drive', 'condition',

# Encode all categorical columns
for col in categorical_columns:
    if col in df.columns:  # Ensure the column exists in the dataset
        df[col] = LabelEncoder().fit_transform(df[col].astype(str))

# Drop the original columns
df = df.drop(columns=['odometer', 'year', 'sellingprice'], errors='ignore')

# Show the first 10 rows of the processed DataFrame
df.head(10)
```

Out[40]:

	make	model	body	transmission	condition	color	odometer_group	year_group	price
0	24	637	35	0	40	16	1	4	
1	24	637	35	0	40	16	1	4	
2	3	8	36	0	35	8	1	3	
3	51	575	36	0	31	16	1	4	
4	3	33	36	0	33	8	1	3	
5	36	63	36	0	0	8	1	4	
6	3	406	36	0	24	2	1	3	
7	7	186	36	0	10	2	2	3	
8	2	46	36	0	32	16	1	3	
9	7	135	9	0	20	13	1	3	

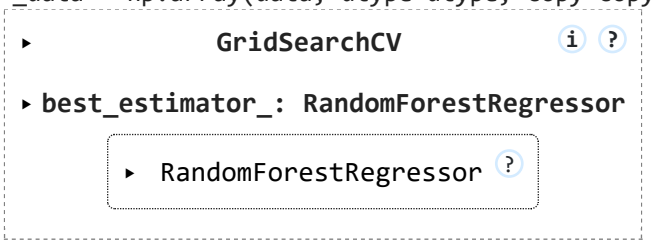
In [41]:
```
# Define features (X) and target (y)
X = df.drop(columns='price_group')
y = df['price_group']

# Train/test split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_sta
```

In [ ]:
```
from sklearn.model_selection import GridSearchCV
#https://www.kaggle.com/code/syedanwarafridi/eda-visualizaton-random-forest-on-vehi
```

```
# code to find out best parameters sourced from kaggle forum

# Random Forest hyperparameter tuning using GridSearchCV
rf_param_grid = {
    'n_estimators': [50, 100],
    'max_depth': [30, 40, 50],
    'min_samples_split': [8, 12],
    'min_samples_leaf': [4, 5]
}

# Instantiate the model using the best parameters
rf_model = RandomForestRegressor(  )
rf_best = GridSearchCV(rf_model, rf_param_grid, cv=5, scoring='neg_mean_squared_err

# Fit the model to the training data
rf_best.fit(X_train, y_train)
```

```
Fitting 5 folds for each of 24 candidates, totalling 120 fits
c:\Users\mjcul\OneDrive\Documents\GitHub\DataScience\venv\lib\site-packages\numpy\ma
\core.py:2881: RuntimeWarning: invalid value encountered in cast
  _data = np.array(data, dtype=dtype, copy=copy,
```

Out[ ]:



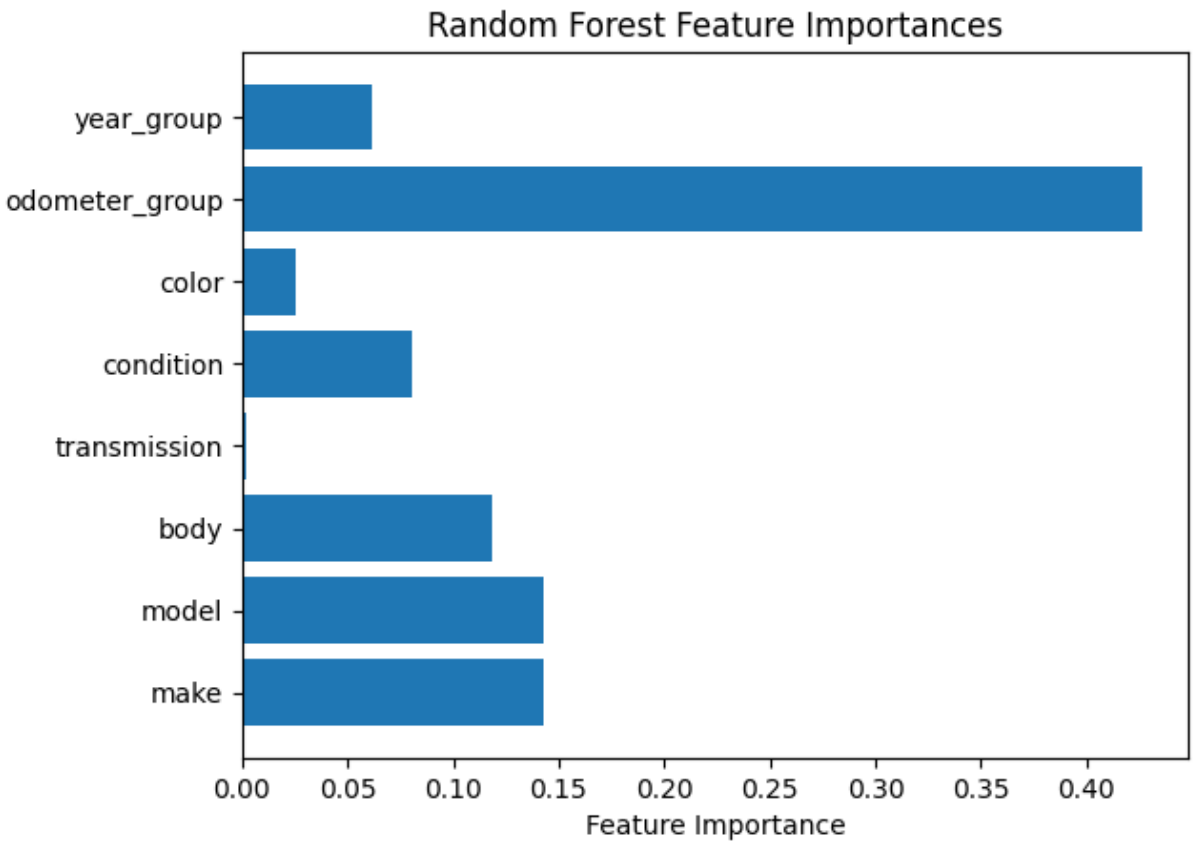
In [43]:

```
# Make predictions
y_pred = rf_best.predict(X_test)

# Evaluate the model
mse = mean_squared_error(y_test, y_pred)
print(f'Mean Squared Error: {mse:.2f}')

r2 = r2_score(y_test, y_pred)
print(f'R-squared: {r2:.2f}')
```

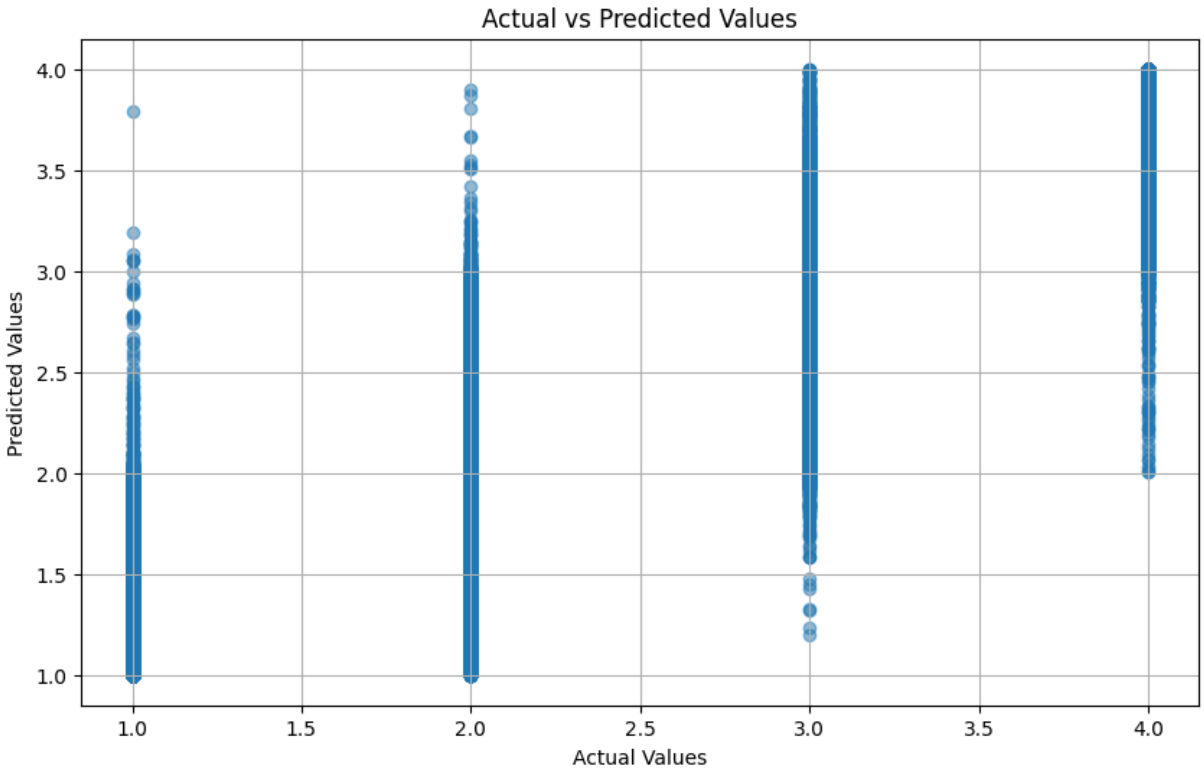
```
Mean Squared Error: 0.10
R-squared: 0.77
```

In [44]:

```
importances = rf_best.best_estimator_.feature_importances_
plt.barh(X.columns, importances)
plt.xlabel("Feature Importance")
plt.title("Random Forest Feature Importances")
plt.show()
```



In [45]:
```
# Scatter plot for actual vs predicted values
plt.figure(figsize=(10, 6))

plt.scatter(y_test, y_pred, alpha=0.5)
plt.title('Actual vs Predicted Values')
plt.xlabel('Actual Values')
plt.ylabel('Predicted Values')
plt.grid(True)
plt.show()
```


Actual vs Predicted Values
Predicted Values
Actual Values
1.0
1.5
2.0
2.5
3.0
3.5
4.0