Importing Libraries

In [1]:
```
import tensorflow as tf
import keras
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import cv2
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense,
import os
```

Loading Data

In [6]:
```
def load_data(working_dir):
    X = []
    Y = []

    for root, dirs, all_images in os.walk(working_dir):
        for image in all_images:
            try:
                img = cv2.imread(os.path.join(root, image))
                img = cv2.resize(img, (300, 300))
                img = img / 255
                X.append(img)
                Y.append(root.split('\\')[-1])
            except Exception as e:
                pass


    X = np.array(X)
    Y = np.array(Y)

    return X, Y
```

In [7]:
```
working_dir = r"D:\\CV\\Vegetable_vs_fruit\\dataset\\train\\"
X, Y = load_data(working_dir)
```

In [8]:
```
print(f"X = {X.shape}")
print(f"Y = {Y.shape}")
```

```
X = (3114, 300, 300, 3)
Y = (3114,)
```

In [9]:
```
import joblib
joblib.dump(X,"Input_X.pkl")
joblib.dump(Y,"Target_Y.pkl")
```

Out[9]:
```
['Target_Y.pkl']
```

Encoding Target

In [10]:
```
Y
```

Out[10]:
```
array(['apple', 'apple', 'apple', ..., 'watermelon', 'watermelon',
       'watermelon'], dtype='<U13')
```

In [11]:
```
from sklearn.preprocessing import LabelEncoder
encoder = LabelEncoder()
Y = encoder.fit_transform(Y)
Y
```

Out[11]:
```
array([ 0,  0,  0, ..., 35, 35, 35], dtype=int64)
```

In [12]:
```
encoder.classes_
```

Out[12]:
```
array(['apple', 'banana', 'beetroot', 'bell pepper', 'cabbage',
       'capsicum', 'carrot', 'cauliflower', 'chilli pepper', 'corn',
       'cucumber', 'eggplant', 'garlic', 'ginger', 'grapes', 'jalepeno',
       'kiwi', 'lemon', 'lettuce', 'mango', 'onion', 'orange', 'paprika',
       'pear', 'peas', 'pineapple', 'pomegranate', 'potato', 'raddish',
       'soy beans', 'spinach', 'sweetcorn', 'sweetpotato', 'tomato',
       'turnip', 'watermelon'], dtype='<U13')
```

Displaying sample img

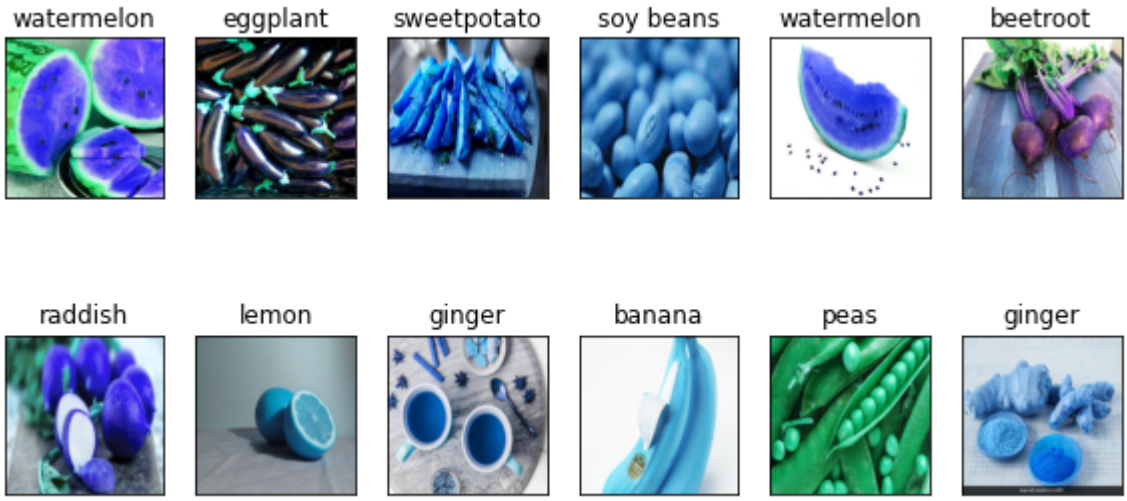
In [14]:

```
import random
sample_img = [random.randint(1,len(X)) for i in range(12)]
sample_img

fig, axes = plt.subplots(2, 6,figsize=(10, 5))

for i in range(12):
    axes[i // 6, i % 6].imshow(X[sample_img[i]])
    axes[i // 6, i % 6].set_title(f"{encoder.classes_[Y[sample_img[i]]]}")
    axes[i // 6, i % 6].get_xaxis().set_visible(False)
    axes[i // 6, i % 6].get_yaxis().set_visible(False)

```



Modelling

In [15]:

```
# Define the CNN model architecture.
model = Sequential()

# 1 CNN
model.add(Conv2D(32, (3, 3), activation='relu', input_shape=(300, 300, 3))
model.add(MaxPooling2D((2, 2)))

# 2CNN
model.add(Conv2D(64, (3, 3), activation='relu'))
model.add(MaxPooling2D((2, 2)))

# 3 Fully Connected Layers
model.add(Flatten())

model.add(Dense(128, activation='relu'))

model.add(Dense(64, activation='relu'))

# 4 Output Layer
model.add(Dense(36, activation='softmax'))

# Compile the model.
model.compile(loss="sparse_categorical_crossentropy",optimizer="adam",metr
```

In [16]:

```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 298, 298, 32)      896

 max_pooling2d (MaxPooling2D  (None, 149, 149, 32)     0
 )

 conv2d_1 (Conv2D)           (None, 147, 147, 64)      18496

 max_pooling2d_1 (MaxPooling  (None, 73, 73, 64)       0
 2D)

 flatten (Flatten)           (None, 341056)            0

 dense (Dense)               (None, 128)               43655296

 dense_1 (Dense)             (None, 64)                8256

 dense_2 (Dense)             (None, 36)                2340

=================================================================
Total params: 43,685,284
Trainable params: 43,685,284
Non-trainable params: 0
_________________________________________________________________
```

In [17]:

```
# Train the model.
model.fit(X, Y, batch_size=32, epochs=5)
```

```
Epoch 1/5
98/98 [==============================] - 153s 2s/step - loss: 4.7301 - accura
cy: 0.0446
Epoch 2/5
98/98 [==============================] - 145s 1s/step - loss: 3.1011 - accura
cy: 0.1358
Epoch 3/5
98/98 [==============================] - 151s 2s/step - loss: 2.3295 - accura
cy: 0.3706
Epoch 4/5
98/98 [==============================] - 146s 1s/step - loss: 1.1224 - accura
cy: 0.7001
Epoch 5/5
98/98 [==============================] - 147s 1s/step - loss: 0.4529 - accura
cy: 0.8956
```

Out[17]:

```
<keras.callbacks.History at 0x196cd500b20>
```

In [18]:

```
1 joblib.dump(model,"model_5_epoch.pkl")
```

```
Keras weights file (<HDF5 file "variables.h5" (mode r+)>) saving:
...layers\conv2d
......vars
.........0
.........1
...layers\conv2d_1
......vars
.........0
.........1
...layers\dense
......vars
.........0
.........1
...layers\dense_1
......vars
.........0
.........1
...layers\dense_2
......vars
.........0
.........1
...layers\flatten
......vars
...layers\max_pooling2d
......vars
...layers\max_pooling2d_1
......vars
...metrics\mean
......vars
.........0
.........1
...metrics\mean_metric_wrapper
......vars
.........0
.........1
...optimizer
......vars
.........0
.........1
.........10
.........11
.........12
.........13
.........14
.........15
.........16
.........17
.........18
.........19
.........2
.........20
.........3
.........4
.........5
.........6
.........7
.........8
```

```
.........9
...vars
Keras model archive saving:
File Name                                                 Modified             Si
ze
config.json                                          2023-05-27 12:20:05         35
15
metadata.json                                        2023-05-27 12:20:05
64
variables.h5                                         2023-05-27 12:20:06    5242591
76
```

Out[18]: ['model_5_epoch.pkl']

Testing my model

In [19]:
```python
def classify_image(path):
    og = cv2.imread(path)
    p1 = cv2.resize(og,(300,300))
    p1 = p1/255
    p1 = np.array([p1])
    prediction = model.predict(p1)
    probability = np.argmax(prediction)
    output = encoder.classes_[probability]
    plt.imshow(og)
    plt.title(output)
```

In [23]:
```python
classify_image(r"D:\CV\Vegetable_vs_fruit\dataset\test\apple\Image_1.jpg")
```

```
1/1 [==============================] - 0s 41ms/step
```