In [1]:
```
import tensorflow as tf
from tensorflow.keras import models, layers
import matplotlib.pyplot as plt
import numpy as np
```

```
WARNING:tensorflow:From C:\Users\muaaz\anaconda3\Lib\site-packages\keras\src\losses.py:2976: The name tf.losses.sparse_softmax_cross_entropy is deprecated. Please use tf.compat.v1.losses.sparse_softmax_cross_entropy instead.
```

# Load Data

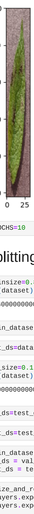
In [4]:
```
Image_size=256
Batch_size=32
dataset=tf.keras.preprocessing.image_dataset_from_directory(
    "project AI",
    shuffle=True,
    image_size=(Image_size,Batch_size),
    batch_size=Batch_size
)
```

```
Found 2146 files belonging to 3 classes.
```

In [5]:
```
class_names=dataset.class_names
class_names
```

Out[5]:
```
['Potato___Early_blight', 'Potato___Late_blight', 'Potato___healthy']
```

In [25]:
```
for image_batch, labels_batch in dataset.take(1):
        plt.imshow(image_batch[1].numpy().astype("uint8"))
```




In [26]:
```
EMPOCHS=10
```

# Splitting Data

In [27]:
```
trainsize=0.8
len(dataset)*trainsize
```

Out[27]:
```
54.400000000000006
```

In [28]:
```
train_dataset=dataset.take(54)
```

In [29]:
```
test_ds=dataset.skip(54)
```

In [31]:
```
val_size=0.1
len(dataset)*val_size
```

Out[31]:
```
6.800000000000001
```

In [32]:
```
val_ds=test_ds.take(6)
```

In [33]:
```
test_ds=test_ds.skip(6)
```

In [35]:
```
train_dataset = train_dataset.cache().shuffle(1000).prefetch(buffer_size=tf.data.AUTOTUNE)
val_ds = val_ds.cache().shuffle(1000).prefetch(buffer_size=tf.data.AUTOTUNE)
test_ds = test_ds.cache().shuffle(1000).prefetch(buffer_size=tf.data.AUTOTUNE)
```

In [37]:
```
resize_and_rescale = tf.keras.Sequential([
  layers.experimental.preprocessing.Resizing(Image_size, Image_size),
  layers.experimental.preprocessing.Rescaling(1./255),
])
```

```
WARNING:tensorflow:From C:\Users\muaaz\anaconda3\Lib\site-packages\keras\src\backend.py:873: The name tf.get_default_graph is deprecated. Please use tf.compat.v1.get_default_graph instead.
```

In [38]:
```
data_augmentation = tf.keras.Sequential([
  layers.experimental.preprocessing.RandomFlip("horizontal_and_vertical"),
  layers.experimental.preprocessing.RandomRotation(0.2),
])
```

# Making Model

In [41]:
```
CHANNELS=3
input_shape = (Batch_size, Image_size, Image_size, CHANNELS)
n_classes = 3

model = models.Sequential([
    resize_and_rescale,
    layers.Conv2D(32, kernel_size = (3,3), activation='relu', input_shape=input_shape),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64,  kernel_size = (3,3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64,  kernel_size = (3,3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Flatten(),
    layers.Dense(64, activation='relu'),
    layers.Dense(n_classes, activation='softmax'),
])
```

```
WARNING:tensorflow:From C:\Users\muaaz\anaconda3\Lib\site-packages\keras\src\layers\pooling\max_pooling2d.py:161: The name tf.nn.max_pool is deprecated. Please use tf.nn.max_pool2d instead.
```

In [42]:
```
model.compile(
    optimizer='adam',
    loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=False),
    metrics=['accuracy']
)
```

```
WARNING:tensorflow:From C:\Users\muaaz\anaconda3\Lib\site-packages\keras\src\optimizers\__init__.py:309: The name tf.train.Optimizer is deprecated. Please use tf.compat.v1.train.Optimizer instead.
```

# Training

In [43]:
```
history = model.fit(
    train_dataset,
    batch_size=Batch_size,
    validation_data=val_ds,
    verbose=1,
    epochs=30,
)
```

```
Epoch 1/30
WARNING:tensorflow:From C:\Users\muaaz\anaconda3\Lib\site-packages\keras\src\utils\tf_utils.py:492: The name tf.ragged.RaggedTensorValue is deprecated. Please use tf.compat.v1.ragged.RaggedTensorValue instead.

WARNING:tensorflow:From C:\Users\muaaz\anaconda3\Lib\site-packages\keras\src\engine\base_layer_utils.py:384: The name tf.executing_eagerly_outside_functions is deprecated. Please use tf.compat.v1.executing_eagerly_outside_functions instead.

54/54 [==============================] - 96s 2s/step - loss: 0.8919 - accuracy: 0.5295 - val_loss: 0.8915 - val_accuracy: 0.5521
Epoch 2/30
54/54 [==============================] - 83s 2s/step - loss: 0.6406 - accuracy: 0.7263 - val_loss: 0.6202 - val_accuracy: 0.6875
Epoch 3/30
54/54 [==============================] - 83s 2s/step - loss: 0.5100 - accuracy: 0.7940 - val_loss: 0.3982 - val_accuracy: 0.8021
Epoch 4/30
54/54 [==============================] - 83s 2s/step - loss: 0.3932 - accuracy: 0.8380 - val_loss: 0.3331 - val_accuracy: 0.8698
Epoch 5/30
54/54 [==============================] - 84s 2s/step - loss: 0.3030 - accuracy: 0.8843 - val_loss: 0.2143 - val_accuracy: 0.9271
Epoch 6/30
54/54 [==============================] - 63s 1s/step - loss: 0.2188 - accuracy: 0.9028 - val_loss: 0.2786 - val_accuracy: 0.8854
Epoch 7/30
54/54 [==============================] - 65s 1s/step - loss: 0.1796 - accuracy: 0.9306 - val_loss: 0.2727 - val_accuracy: 0.9062
Epoch 8/30
54/54 [==============================] - 66s 1s/step - loss: 0.1812 - accuracy: 0.9340 - val_loss: 0.1456 - val_accuracy: 0.9271
Epoch 9/30
54/54 [==============================] - 67s 1s/step - loss: 0.1392 - accuracy: 0.9433 - val_loss: 0.1437 - val_accuracy: 0.9427
Epoch 10/30
54/54 [==============================] - 65s 1s/step - loss: 0.1197 - accuracy: 0.9560 - val_loss: 0.1421 - val_accuracy: 0.9323
Epoch 11/30
54/54 [==============================] - 64s 1s/step - loss: 0.0648 - accuracy: 0.9716 - val_loss: 0.2195 - val_accuracy: 0.9115
Epoch 12/30
54/54 [==============================] - 64s 1s/step - loss: 0.0709 - accuracy: 0.9716 - val_loss: 0.1137 - val_accuracy: 0.9583
Epoch 13/30
54/54 [==============================] - 64s 1s/step - loss: 0.0687 - accuracy: 0.9728 - val_loss: 0.0830 - val_accuracy: 0.9635
Epoch 14/30
54/54 [==============================] - 64s 1s/step - loss: 0.0501 - accuracy: 0.9832 - val_loss: 0.0864 - val_accuracy: 0.9688
Epoch 15/30
54/54 [==============================] - 65s 1s/step - loss: 0.0792 - accuracy: 0.9728 - val_loss: 0.0864 - val_accuracy: 0.9583
Epoch 16/30
54/54 [==============================] - 64s 1s/step - loss: 0.0419 - accuracy: 0.9861 - val_loss: 0.0877 - val_accuracy: 0.9688
Epoch 17/30
54/54 [==============================] - 65s 1s/step - loss: 0.0191 - accuracy: 0.9948 - val_loss: 0.0829 - val_accuracy: 0.9635
Epoch 18/30
54/54 [==============================] - 66s 1s/step - loss: 0.0092 - accuracy: 0.9977 - val_loss: 0.0992 - val_accuracy: 0.9688
Epoch 19/30
54/54 [==============================] - 65s 1s/step - loss: 0.0088 - accuracy: 0.9977 - val_loss: 0.1398 - val_accuracy: 0.9688
Epoch 20/30
54/54 [==============================] - 65s 1s/step - loss: 0.0390 - accuracy: 0.9890 - val_loss: 0.0796 - val_accuracy: 0.9583
Epoch 21/30
54/54 [==============================] - 64s 1s/step - loss: 0.0439 - accuracy: 0.9861 - val_loss: 0.0737 - val_accuracy: 0.9635
Epoch 22/30
54/54 [==============================] - 64s 1s/step - loss: 0.0675 - accuracy: 0.9786 - val_loss: 0.3676 - val_accuracy: 0.8750
Epoch 23/30
54/54 [==============================] - 65s 1s/step - loss: 0.0612 - accuracy: 0.9769 - val_loss: 0.1276 - val_accuracy: 0.9635
Epoch 24/30
54/54 [==============================] - 66s 1s/step - loss: 0.0302 - accuracy: 0.9902 - val_loss: 0.0961 - val_accuracy: 0.9740
Epoch 25/30
54/54 [==============================] - 64s 1s/step - loss: 0.0274 - accuracy: 0.9913 - val_loss: 0.0582 - val_accuracy: 0.9792
Epoch 26/30
54/54 [==============================] - 65s 1s/step - loss: 0.0271 - accuracy: 0.9896 - val_loss: 0.0901 - val_accuracy: 0.9688
Epoch 27/30
54/54 [==============================] - 65s 1s/step - loss: 0.0210 - accuracy: 0.9925 - val_loss: 0.1098 - val_accuracy: 0.9740
Epoch 28/30
54/54 [==============================] - 64s 1s/step - loss: 0.0148 - accuracy: 0.9954 - val_loss: 0.2181 - val_accuracy: 0.9375
Epoch 29/30
54/54 [==============================] - 237s 4s/step - loss: 0.0542 - accuracy: 0.9792 - val_loss: 0.0779 - val_accuracy: 0.9740
Epoch 30/30
54/54 [==============================] - 64s 1s/step - loss: 0.0183 - accuracy: 0.9925 - val_loss: 0.0763 - val_accuracy: 0.9740
```

# Testing

In [44]:
```
scores=model.evaluate(test_ds)
```

```
8/8 [==============================] - 2s 193ms/step - loss: 0.0622 - accuracy: 0.9823
```

In [45]:
```
scores
```

Out[45]:
```
[0.06220560148358345, 0.9823008775711106]
```

In [46]:
```
history.params
```

Out[46]:
```
{'verbose': 1, 'epochs': 30, 'steps': 54}
```

In [47]:
```
history.history.keys()
```

Out[47]:
```
dict_keys(['loss', 'accuracy', 'val_loss', 'val_accuracy'])
```

In [50]:
```
acc = history.history['accuracy']
val_acc = history.history['val_accuracy']

loss = history.history['loss']
val_loss = history.history['val_loss']
```

In [51]:
```
for images_batch, labels_batch in test_ds.take(1):

    first_image = images_batch[0].numpy().astype('uint8')
    first_label = labels_batch[0].numpy()

    print("first image to predict")
    plt.imshow(first_image)
    print("actual label:",class_names[first_label])

    batch_prediction = model.predict(images_batch)
    print("predicted label:",class_names[np.argmax(batch_prediction[0])])
```

```
first image to predict
actual label: Potato___Early_blight
1/1 [==============================] - 0s 398ms/step
predicted label: Potato___Early_blight
```


# Store model in a file

In [53]:
```
import os
model_version=max([int(i) for i in os.listdir("models") + [0]])+1
model.save(f"models/{model_version}")
```

```
INFO:tensorflow:Assets written to: models/1\assets
INFO:tensorflow:Assets written to: models/1\assets
```

In [ ]: