In [13]:
```
import os
import tensorflow as tf
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras import layers, models
from tensorflow.keras.optimizers import Adam
import matplotlib.pyplot as plt
import numpy as np
from tensorflow.keras.preprocessing import image
```

In [2]:
```
train_dir = 'C:\\Users\\sd616\\Downloads\\sp\\chest_xray\\train'
val_dir = 'C:\\Users\\sd616\\Downloads\\sp\\chest_xray\\val'
test_dir = 'C:\\Users\\sd616\\Downloads\\sp\\chest_xray\\test'
```

In [3]:
```
train_datagen = ImageDataGenerator(
    rescale=1./255,   # Normalize pixel values to [0, 1]
    shear_range=0.2,  # Random shear
    zoom_range=0.2,   # Random zoom
    horizontal_flip=True  # Randomly flip images
)

val_datagen = ImageDataGenerator(rescale=1./255)
```

In [4]:
```
train_generator = train_datagen.flow_from_directory(
    train_dir,
    target_size=(150, 150),  # Resize all images to 150x150
    batch_size=32,           # Process 32 images at a time
    class_mode='binary'      # Binary classification: pneumonia or normal
)
```

```
Found 5216 images belonging to 2 classes.
```

In [5]:
```
val_generator = val_datagen.flow_from_directory(
    val_dir,
    target_size=(150, 150),
    batch_size=32,
    class_mode='binary'
)
```

```
Found 16 images belonging to 2 classes.
```

In [6]:
```
model = models.Sequential()

# First convolutional layer
model.add(layers.Conv2D(32, (3, 3), activation='relu', input_shape=(150, 15
model.add(layers.MaxPooling2D((2, 2)))

# Second convolutional layer
model.add(layers.Conv2D(64, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))

# Third convolutional layer
model.add(layers.Conv2D(128, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))

# Flatten the results to feed into a dense layer
model.add(layers.Flatten())

# Fully connected layer
model.add(layers.Dense(128, activation='relu'))

# Output layer (binary classification)
model.add(layers.Dense(1, activation='sigmoid'))
```

```
C:\Users\sd616\anaconda\lib\site-packages\keras\src\layers\convolutional\b
ase_conv.py:107: UserWarning: Do not pass an `input_shape`/`input_dim` arg
ument to a layer. When using Sequential models, prefer using an `Input(sha
pe)` object as the first layer in the model instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

In [7]:
```
model.compile(
    optimizer=Adam(),
    loss='binary_crossentropy',
    metrics=['accuracy']
)
```

In [8]:
```
history = model.fit(
    train_generator,
    steps_per_epoch=train_generator.samples // train_generator.batch_size,
    epochs=4,  # Set to a higher value for better results
    validation_data=val_generator,
    validation_steps=val_generator.samples // val_generator.batch_size
)
```

```
Epoch 1/4

C:\Users\sd616\anaconda\lib\site-packages\keras\src\trainers\data_adapters
\py_dataset_adapter.py:121: UserWarning: Your `PyDataset` class should cal
l `super().__init__(**kwargs)` in its constructor. `**kwargs` can include
`workers`, `use_multiprocessing`, `max_queue_size`. Do not pass these argu
ments to `fit()`, as they will be ignored.
  self._warn_if_super_not_called()

163/163 ━━━━━━━━━━━━━━━━━━━━ 330s 2s/step - accuracy: 0.7432 - loss: 0.592
2 - val_accuracy: 0.6875 - val_loss: 0.6011
Epoch 2/4

C:\Users\sd616\anaconda\lib\contextlib.py:137: UserWarning: Your input ran
out of data; interrupting training. Make sure that your dataset or generat
or can generate at least `steps_per_epoch * epochs` batches. You may need
to use the `.repeat()` function when building your dataset.
  self.gen.throw(typ, value, traceback)

163/163 ━━━━━━━━━━━━━━━━━━━━ 1s 4ms/step - accuracy: 0.0000e+00 - loss: 0.
0000e+00 - val_accuracy: 0.6875 - val_loss: 0.6011
Epoch 3/4
163/163 ━━━━━━━━━━━━━━━━━━━━ 312s 2s/step - accuracy: 0.8946 - loss: 0.233
2 - val_accuracy: 0.8750 - val_loss: 0.3527
Epoch 4/4
163/163 ━━━━━━━━━━━━━━━━━━━━ 1s 4ms/step - accuracy: 0.0000e+00 - loss: 0.
0000e+00 - val_accuracy: 0.8750 - val_loss: 0.3527
```

In [9]:
```
test_datagen = ImageDataGenerator(rescale=1./255)

test_generator = test_datagen.flow_from_directory(
    test_dir,
    target_size=(150, 150),
    batch_size=32,
    class_mode='binary'
)

test_loss, test_acc = model.evaluate(test_generator)
print(f"Test accuracy: {test_acc}")
```

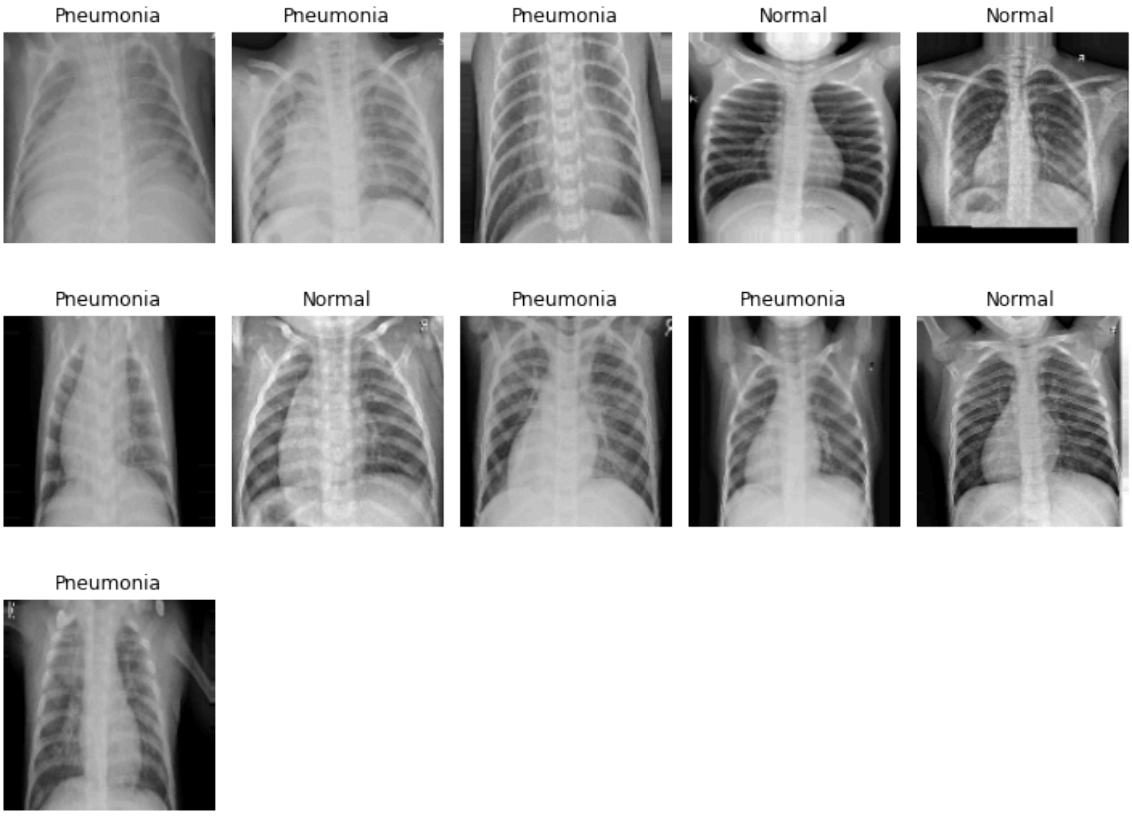
```
Found 624 images belonging to 2 classes.
20/20 ━━━━━━━━━━━━━━━━━━━━ 33s 2s/step - accuracy: 0.8832 - loss: 0.3190
Test accuracy: 0.8830128312110901
```

In [27]:
```
x_batch, y_batch = next(train_generator)

# Plotting the images in the batch
plt.figure(figsize=(10, 10))

for i in range(11):  # Display 9 images
    plt.subplot(4,5 , i + 1)
    plt.imshow(x_batch[i])
    plt.title('Pneumonia' if y_batch[i] == 1 else 'Normal')
    plt.axis('off')

plt.tight_layout()
plt.show()
```



In [11]:
```
def load_and_preprocess_image(img_path):
    img = image.load_img(img_path, target_size=(150, 150))  # Resize image
    img_array = image.img_to_array(img)  # Convert image to array
    img_array = np.expand_dims(img_array, axis=0)  # Add batch dimension (1
    img_array /= 255.0  # Rescale pixel values to [0, 1]
    return img_array
```

In [26]:
```
img_path ='C:\\Users\\sd616\\Downloads\\sp\\chest_xray\\train\\PNEUMONIA\\p

img_array = load_and_preprocess_image(img_path)

# Make a prediction
prediction = model.predict(img_array)

# Output prediction result
if prediction[0] > 0.5:
    print("Pneumonia affected")
else:
    print("Normal")
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 285ms/step
Pneumonia affected
```

In [ ]:
```

```