Real-Time GPS Bus Tracking System (Django + ReactJS)

Step 1: Django Models

- Bus: Represents a single bus, linked to a driver.
- BusLocation: Stores live location updates from the bus.

models.py

```
from django.db import models
from django.contrib.auth.models import User

class Bus(models.Model):
    name = models.CharField(max_length=100)
    driver = models.OneToOneField(User, on_delete=models.CASCADE)
    is_tracking = models.BooleanField(default=False)

class BusLocation(models.Model):
    bus = models.ForeignKey(Bus, on_delete=models.CASCADE)
    latitude = models.FloatField()
    longitude = models.FloatField()
    timestamp = models.DateTimeField(auto_now=True)
```

Step 2: Django API Views

- toggle_tracking: Driver turns GPS tracking on/off.
- update_location: Driver sends current location.

views.py

```
@api_view(['POST'])
@permission_classes([IsAuthenticated])
def toggle_tracking(request):
    ...

@api_view(['POST'])
@permission_classes([IsAuthenticated])
def update_location(request):
    ...
```

Step 3: Django Channels for WebSockets

- Install: pip install channels channels_redis
- Update settings.py:
  - Add 'channels'
  - Set ASGI_APPLICATION and CHANNEL_LAYERS

consumers.py

```
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class BusTrackingConsumer(AsyncWebsocketConsumer):
    async def connect(self):
        ...
    async def receive(self, text_data):
        ...
    async def send_location(self, event):
        ...

routing.py
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re_path(r'ws/track/(?P<bus_id>\d+)/$', BusTrackingConsumer.as_asgi())
```

Step 4: ReactJS - Student Map View

```
Install packages:
------------------
npm install react-leaflet leaflet
import 'leaflet/dist/leaflet.css';

BusTracking.js
----------------
useEffect(() => {
  const socket = new WebSocket(`ws://localhost:8000/ws/track/${busId}/`);
  socket.onmessage = (event) => {
    const data = JSON.parse(event.data);
    setLocation({ lat: data.latitude, lng: data.longitude });
  };
}, [busId]);

<MapContainer center={location} zoom={16}>...</MapContainer>
```