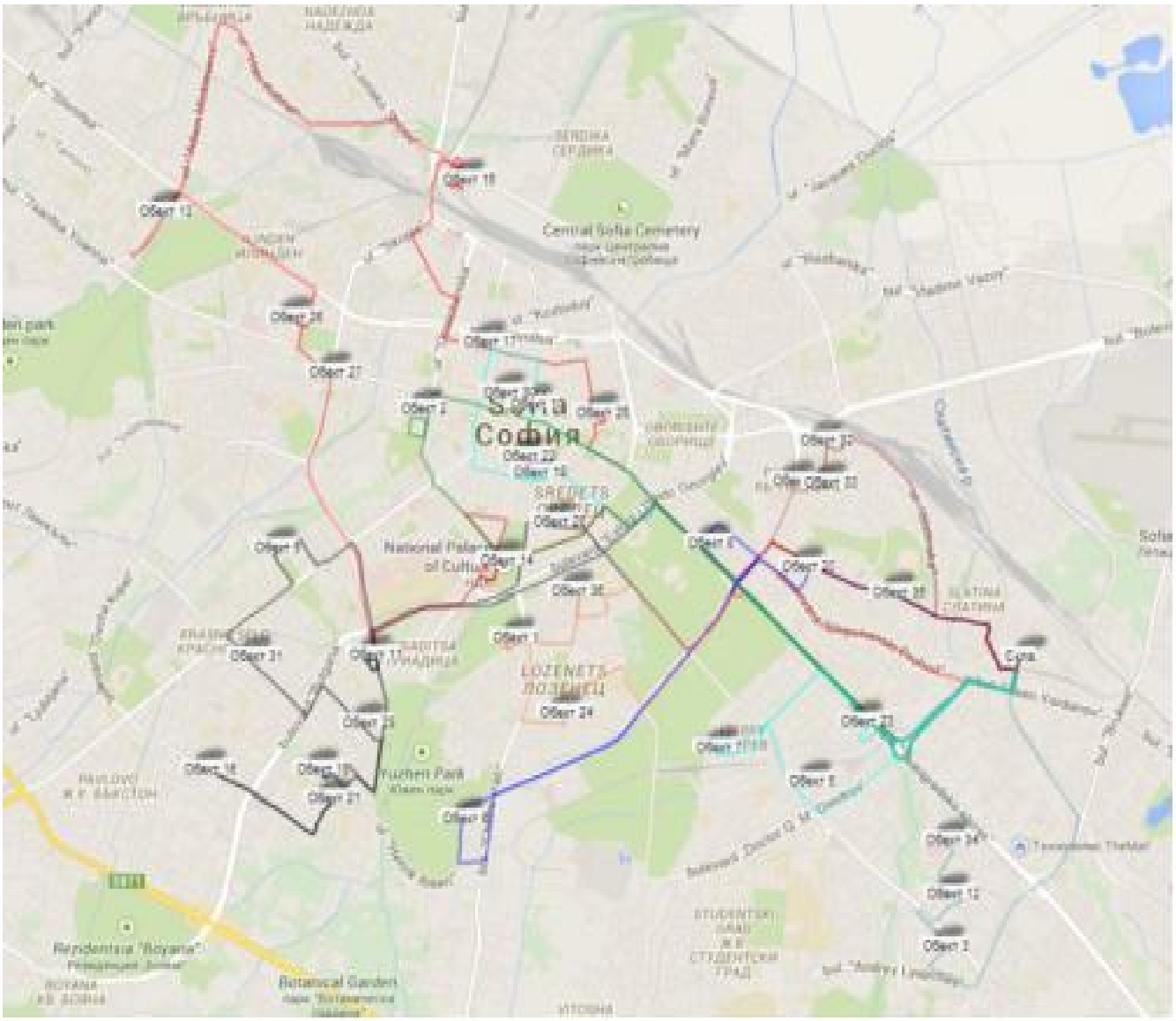
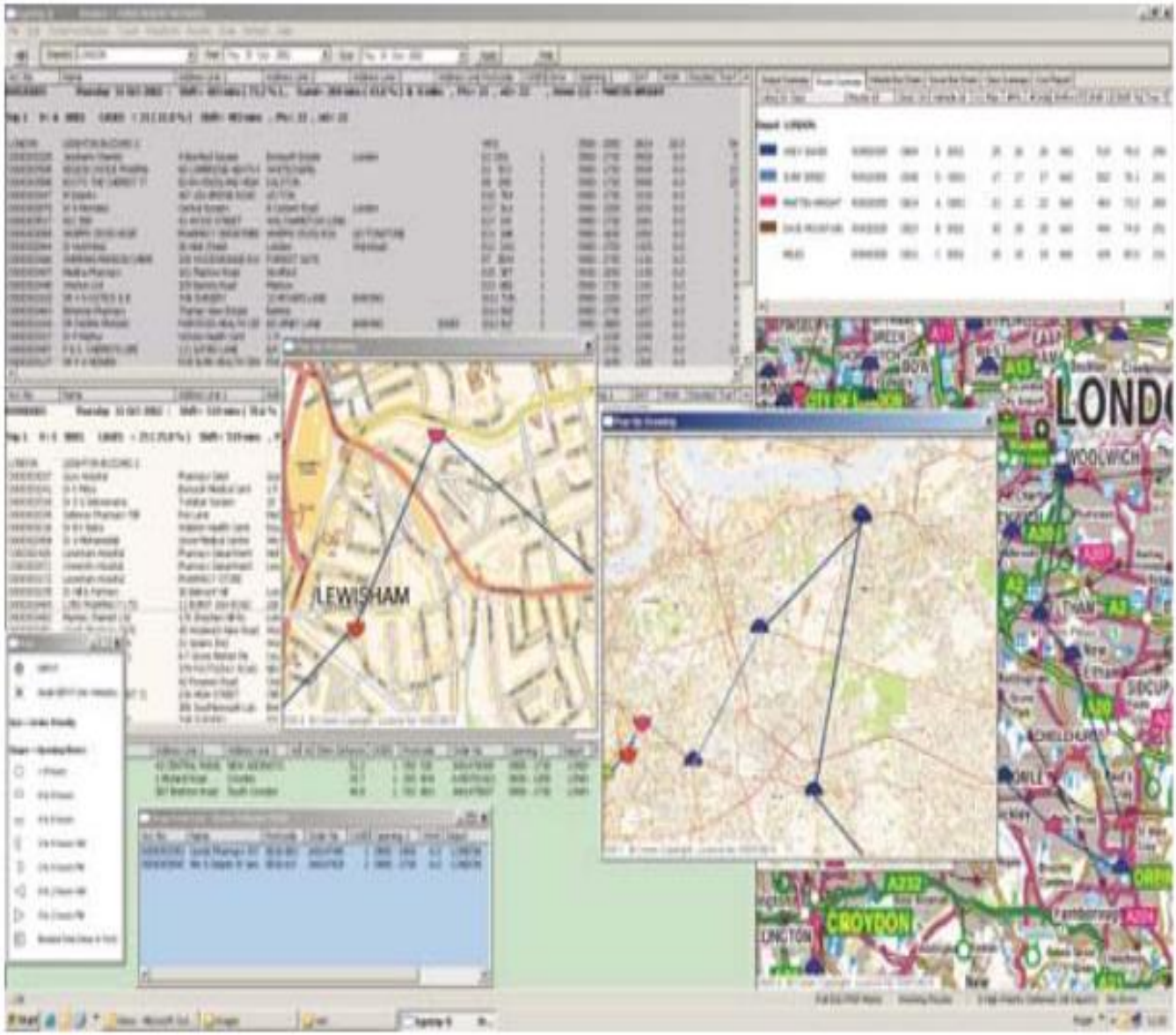
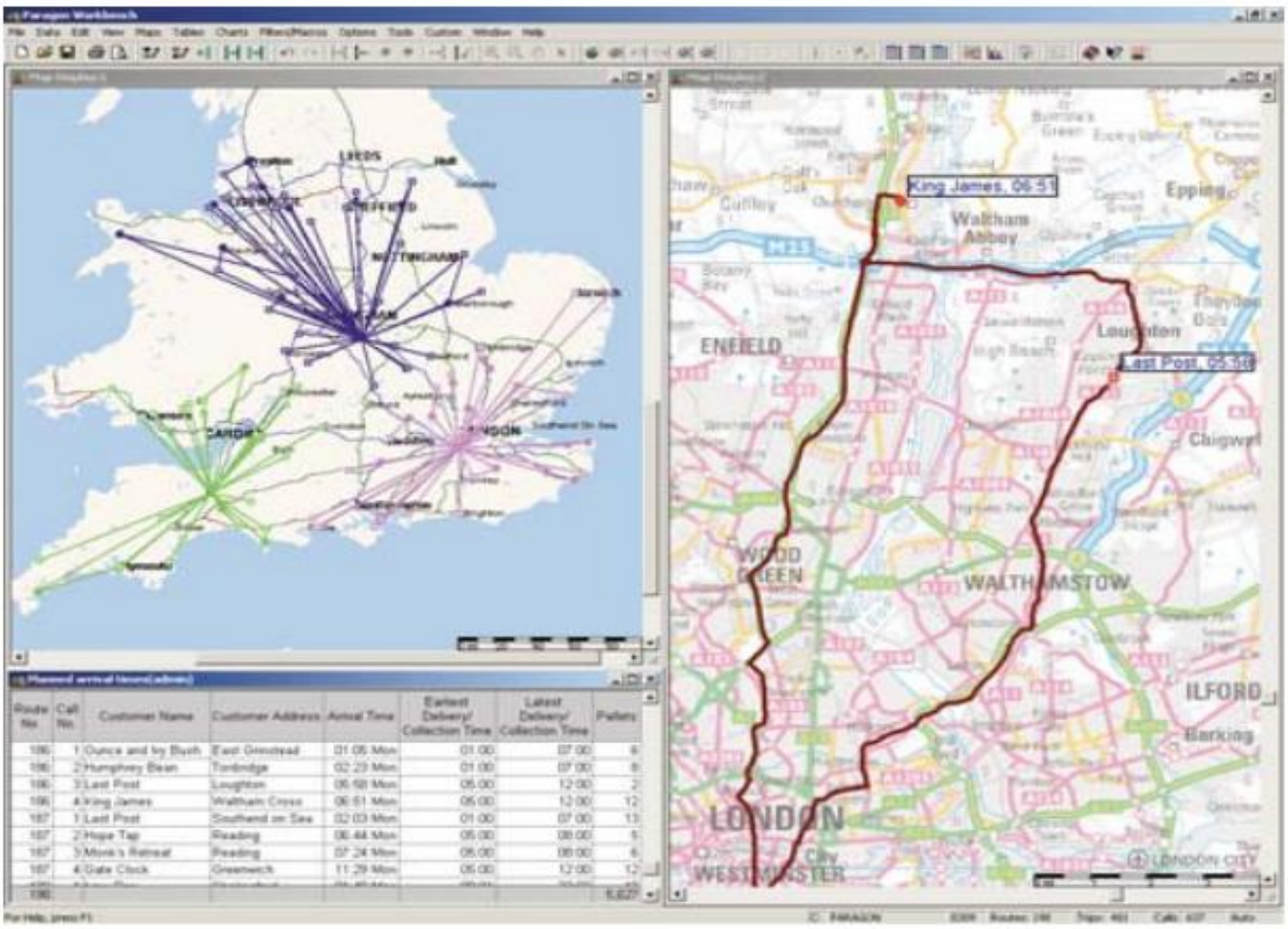
LECTURE NOTE ON SOFTWARES, MAPS, AND INSTRUMENTS TO SUPPORT VEHICLE ROUTING



Routes of Vehicle



Contributing significantly to
knowledge and sustainable living



1 INTRODUCTION

The transportation of goods in urban areas imposes considerable costs on the transport sectors of the economy as well as the environment. More efficient vehicle routing can improve a firm's competitive advantage, increase the efficiency of supplying public services, and reduce energy consumption, traffic congestion and air pollution, which are growing problems in many urban areas.

Broadly speaking, vehicle routing and scheduling problems (VRP) (Toth and Vigo, 2002) involve the optimum assignment and sequencing of a set of transportation orders to a fleet of vehicles, considering various operational constraints. Such constraints have particular importance in those real-life settings where the vehicle fleet is heterogeneous, i.e., vehicles differ in their equipment, capacity, age or cost.

Formally, the Heterogeneous Fleet Vehicle Routing Problem with Time Windows (HFVRPTW) involves the design of a set of minimum cost routes, each originating and terminating at the depot, using a heterogeneous fleet of vehicles with fixed and variable costs, to service a set of customers with known demands. Each customer must be serviced only once, within a predefined time window, by exactly one vehicle, while the total demand of a route must not exceed the capacity of the vehicle type assigned to it.

The use of a heterogeneous fleet of vehicles has multiple advantages (Paraskevopoulos *et al*., 2008). The scheduler can revise the fleet composition to better suit customer needs because they may require vehicles with expensive equipment. It is also possible to service customers requiring small vehicles because of accessibility restrictions in urban areas, environmental concerns or physical restrictions on the vehicle size and weight.

Furthermore, vehicles of different carrying capacities give the flexibility to allocate capacity according to the customer's varying demand, in a more cost effective way, by deploying the appropriate vehicle types to areas with the analogous concentration of customers. The distribution cost of a vehicle derives from the sum of its fixed cost and a variable cost proportional to the distance travelled.

Route planning software is necessary for mobile resource management, route optimization, and real-time visibility for the delivery of operations. Examples of such software are **Computerized Vehicle Routing and Scheduling (CVRS) systems**, and **Route Planning Software** which enhances the following:

- Reduction of time windows delivery;
- Addresses the exceptions on the road;
- Efficiency of routes plan; and
- Responding to customer changes

2 AIM AND OBJECTIVES

The aim of this study is to achieve the following objectives:

- Help student gain an understanding computerized vehicle routing and scheduling (CVRS);
- Provide an overview of CVRS systems, covering their uses, likely benefits, negative aspects and associated costs
- Provide sufficient information to be able to identify, purchase and implement the best solution for organization