Wireless connected tablet-pc and GPS for on-campus micro-mobility research at the University of Milan Bicocca

Mario Boffi
Filippo Dal Fiore
Marianna D'Ovidio
Marco Gui
Emanuele Natoli

EXTENDED ABSTRACT

The university of Milan Bicocca is located within a large perimeter in the area of Northern Milan where several big corporations (Pirelli, Siemens) and large resident buildings are also installed. The mobility pattern of people (university students and employees and other workers and residents) are object of study since many years, not only to determine the better geographical allocation of different on-campus services, but also to decide the proper configuration and use of network technologies.
For this purpose, in November 2004 a pilot research and didactic project was set up at the Dept.of Sociology and Social Sciences, involving 13 Master students. The objectives of the experiment were as follow:

1. To test the integration of GPS technology with GIS applications in the context of a wireless devices-enabled on-campus data collection and in-office data transfer, extension and analysis;
2. To test a network technology-enabled research methodology to study, quantitatively and qualitatively, the pattern of mobility of people inside the campus in different daily time bands among several point of attractions ("attractors");
3. To develop innovative didactic models around state-of-the-art ICT technology-enabled social research

In the following outline the project work-flow is described:
- Planning
    1. Brainstorming session with GPS/GIS experts in order to:
        a. define the data-collection methodology ("shadowing")
        b. identify the starting points for the tracking survey, located nearby the main attractors of the area
        c. choose the best user devices for the experimentation (Acer tablet PC);
    2. Checking the availability of satellite signals in the different campus areas and configuring GPS receivers
- Implementation
    3. 9 sessions of on-field data collection through ArcPad and data transfer to ArcGis
- Evaluation
    4. Aggregation of all results through ArcGis and creation of general maps
    5. Creation of personalized map for different sociological evaluations

As for the hardware technology, tablet pc with GPS receivers (Egnos corrected) were used, communicating wireless.
The software architecture was constituted by an application of ArcGis on the server-side, and an application of ArcPad 6.03 on the client side. Personal and travel-related information was collected with the CAPI (Computer Aided Personal Interviewing) system, which supported an embedded questionnaire in ArcPad, (see fig. 1).

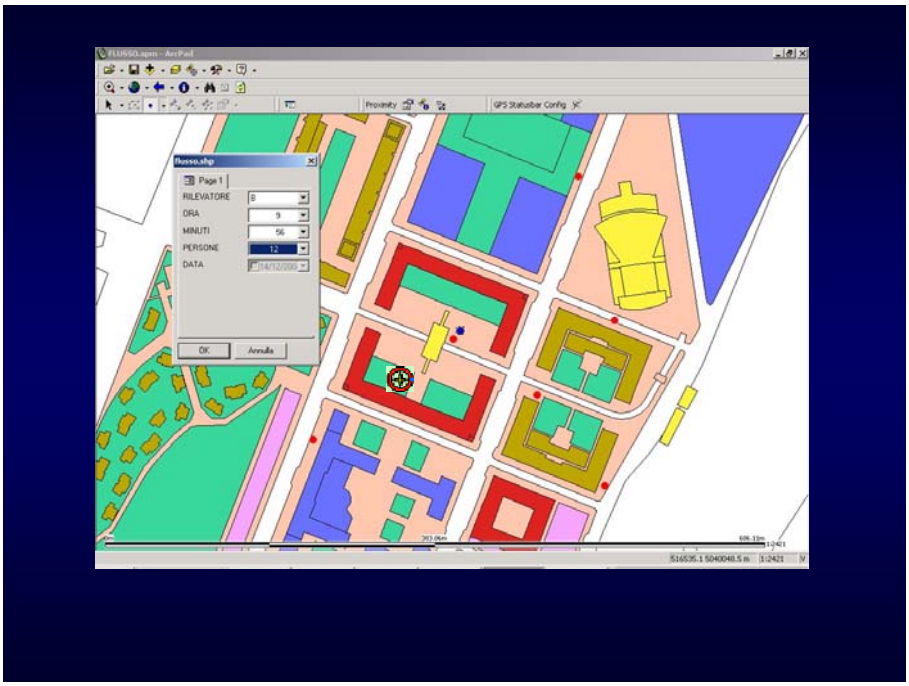

fig.1

The research took place in three different days during three time ranges, each two hours long, in the morning, in the afternoon and in the evening, involving 13 students. In this way it has been possible to observe the most important changes in mobility patterns throughout the day.
The technique used is called “shadowing”, and it is aimed at obtaining images of people's mobility tracks. Observers (our students) were asked to follow, as a “shadow”, and with their permission, randomly selected pedestrians on the moveand consequently to register their paths with GPS.
The subjects of the sample were chosen at their arrival to the railway station and in other relevant buildings, such as University faculties and private companies in the area. Once arrived to the destination, they were asked to answer to a number of short socio-demographic questions, so to associate the tracking to personal characteristics. The students would upload data by getting close to buildings with wireless networks. In addition to this, students also measured fluxes of people (passing through ideal barriers in different locations within the campus), so to weight data collected with path tracing, on the basis of the number of people walking in the area in a certain moment.
At the end, 160 paths had been traced and 160 flux measures had been taken, on 16 different positions within the campus.

The students were on average low-skilled in the use of mobile pc and not at all skilled in the use of geographic information systems and GPS. Nonetheless, the process has been designed so that complex data gathering could be easily managed even by non expert surveyors.
In fig. 2 it is possible to see the collected track points, coloured differently according to the level of accuracy of GPS information. We are working on an evolution of the data flow process and the data set construction, concerning a preliminary transformation on raw data, filtering track points in real time, so to exclude the points with low reliability, as for example the red points in fig. 2.

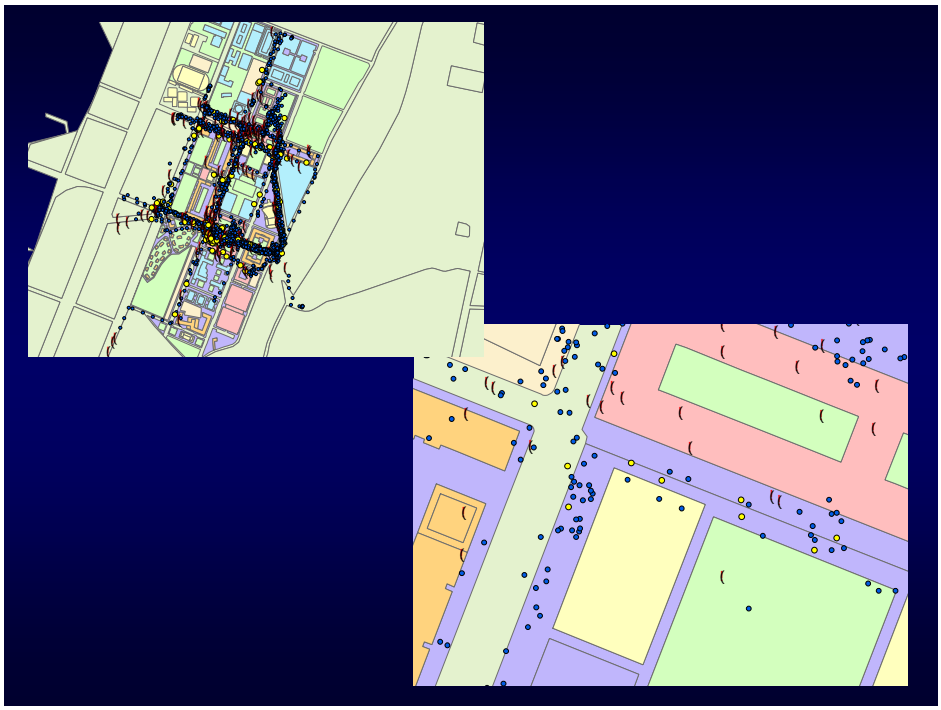

fig. 2

The experiment suggests that the use of wireless technology, in order to collect mobility data, provides:

- an easy data transfer from mobile devices to the server
- a good control on the data quality
- an easy access to the data, once the collections have be done
- an efficient process and management of dataset implementation

As possible future research development we envision Research applications of on campus wireless network together with location based technologies.