

Outdoor Wi-Fi Map Initiative

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Outline

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Introduction

- The Internet has become an integral part of today's society, we use it for numerous things ranging from checking the weather to doing taxes.
- In a city, unaware to us, we're surrounded by numerous Wi-Fi access points, some open some not.
- Outdoor Wi-Fi Map Initiative project collects, stores, and ultimately maps the Wi-Fi data on a geographic map providing users with a clear and simple view of Wi-Fi access points.

Device/Sensor Requirements

- *GPS* - device must be GPS equipped/enabled, or GPS can be added on externally. Frequency is not critical, but accuracy should be at least moderately precise to prevent improper placement of data.
- *Wi-Fi* - device must have Wi-Fi either built in or added on. A minimum of 802.11b is required since nearly all access points support this protocol.
- *Data Upload* - device must allow upload of data to the Internet either via cell networks or Wi-Fi access.

Hardware Platform

- All the Device Requirements (GPS, Wi-Fi, Data Upload) are met by most smartphones available on the market today.
- This effectively eliminates the need for any additional design and therefore cost, since all the required sensors and internet availability is already integrated into one device.



Software

- Operating system– Windows Mobile 6.0, 6.1, & 6.5
- Language Used – C# .NET 3.5
- Development Environment – Visual Studio 2008
- Data Storage - SQL Server Compact 3.5



System/Software Requirements

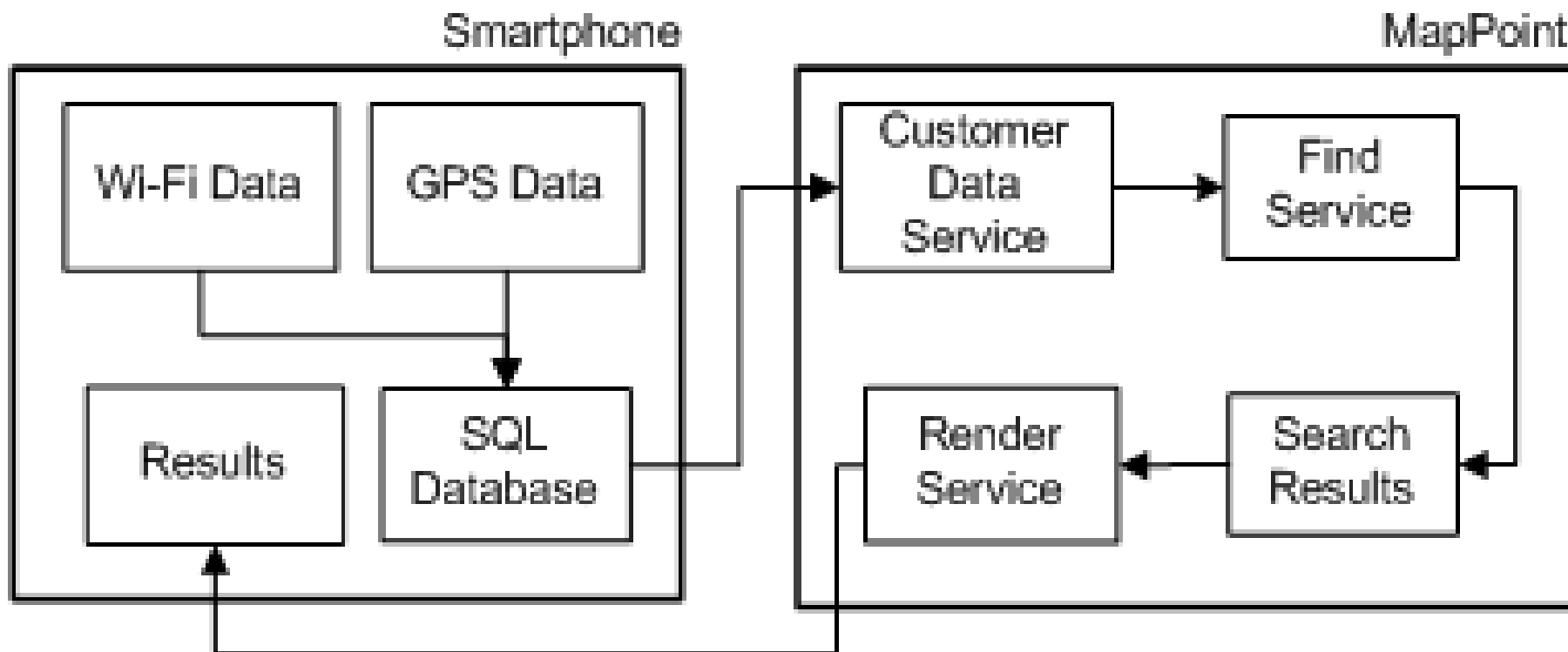
- Additional .NET Framework Requirements - In order to run OWMI application, additional Compact SQL & Compact .NET framework libraries/components need to be installed, approximately 4 MB.
- Storage - Total size of the OWMI application itself along with the supporting libraries is 1.3 MB. Note that this does not include the Framework files or SQL data base size, which will vary.
- RAM - OWMI requires about 2 MB of RAM when active.

MapPoint Web Service

- MapPoint is a web based mapping service provided by Microsoft.
- MapPoint Consists of three separate services:
 - *Customer Data Service (CDS)* – upload or download data.
 - *Find Service* – locate geographic entities.
 - *Render Service* – draw map, place pushpins, etc.



Integrated System



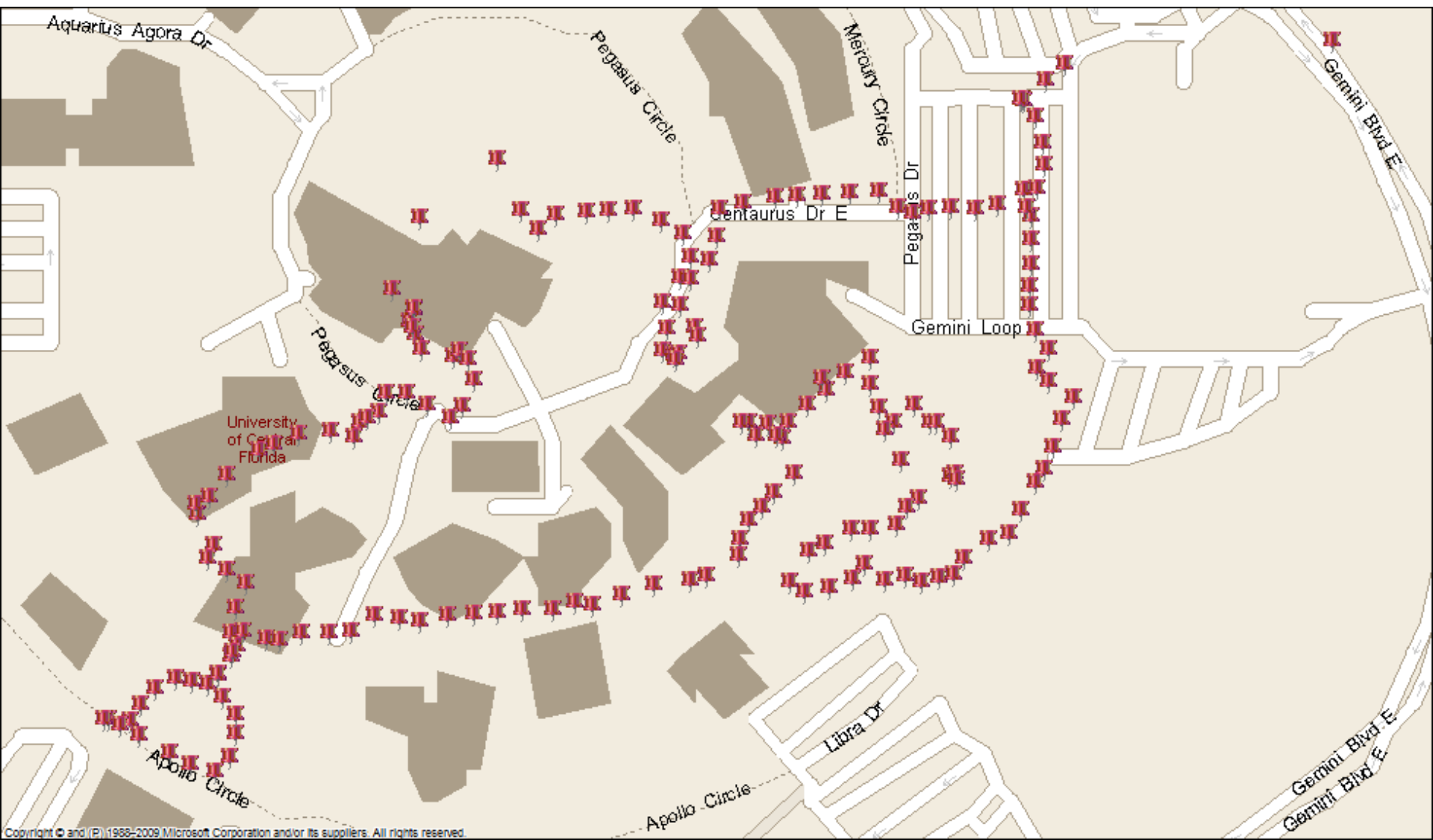
Devices Used

Device	GPS	Wi-Fi	Processor	RAM
1920 (Samsung Omnia II)	Samsung GPS card (Internal)	SWLDM201 (802.11b/802.11g)	800MHz	256MB
T-Mobile Wing	BT QStarz 5hz (External)	Generic (802.11b/802.11g)	201 MHz	44MB

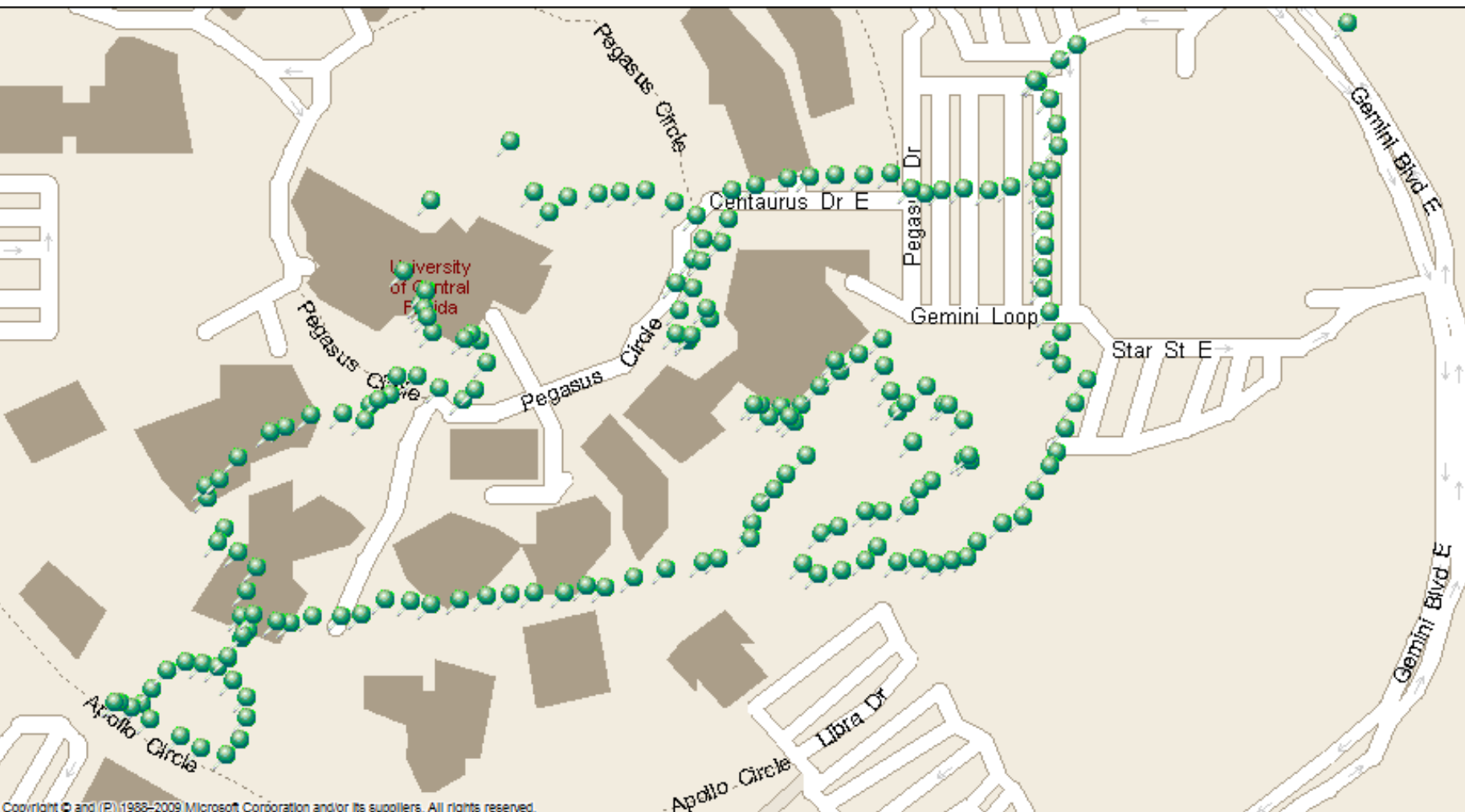
OWMI Demo

- Main OWMI tab
- GPS configuration tab
- Wi-Fi configuration tab
- OWMI Settings tab
- OWMI actively processing
- Map filtering tab
- Map View tab

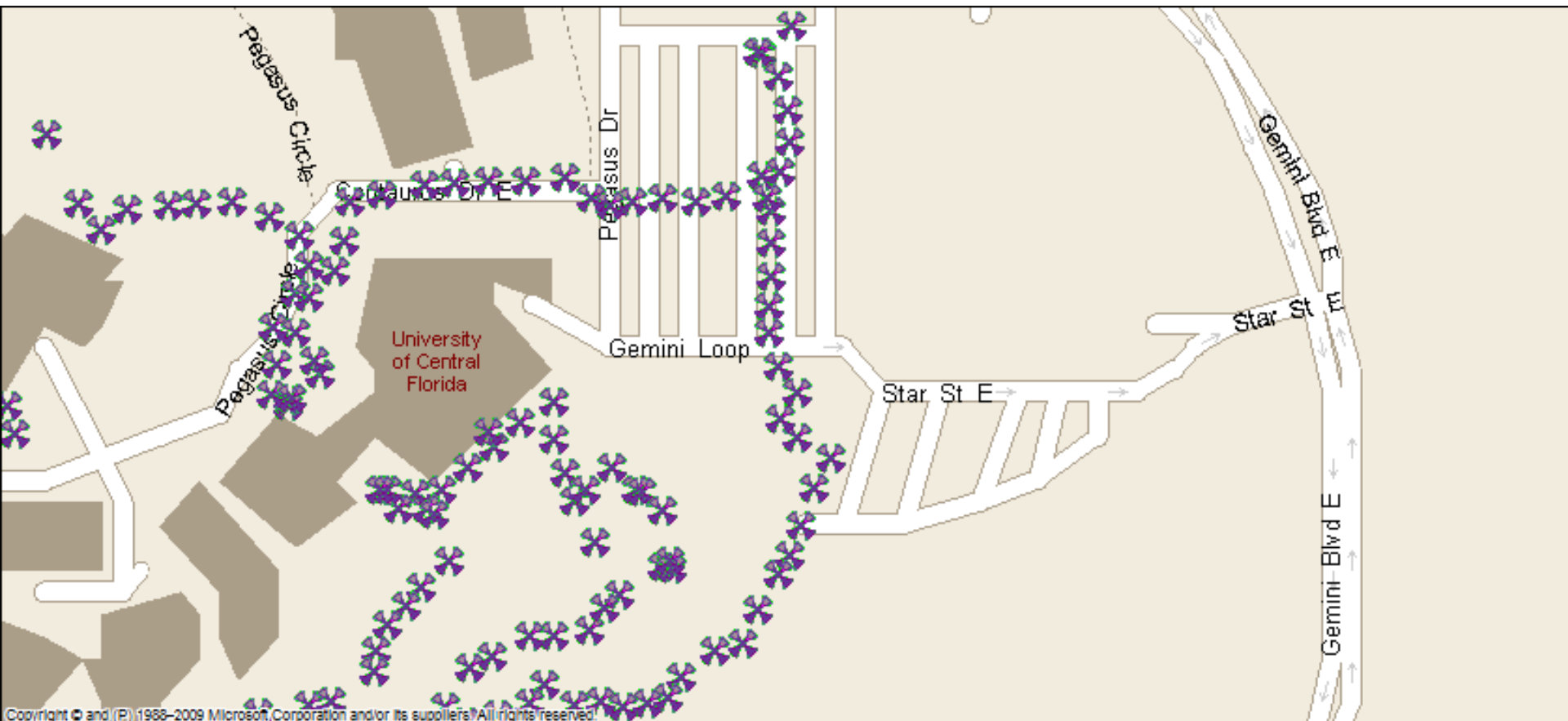
MapPoint: SSID = UCF



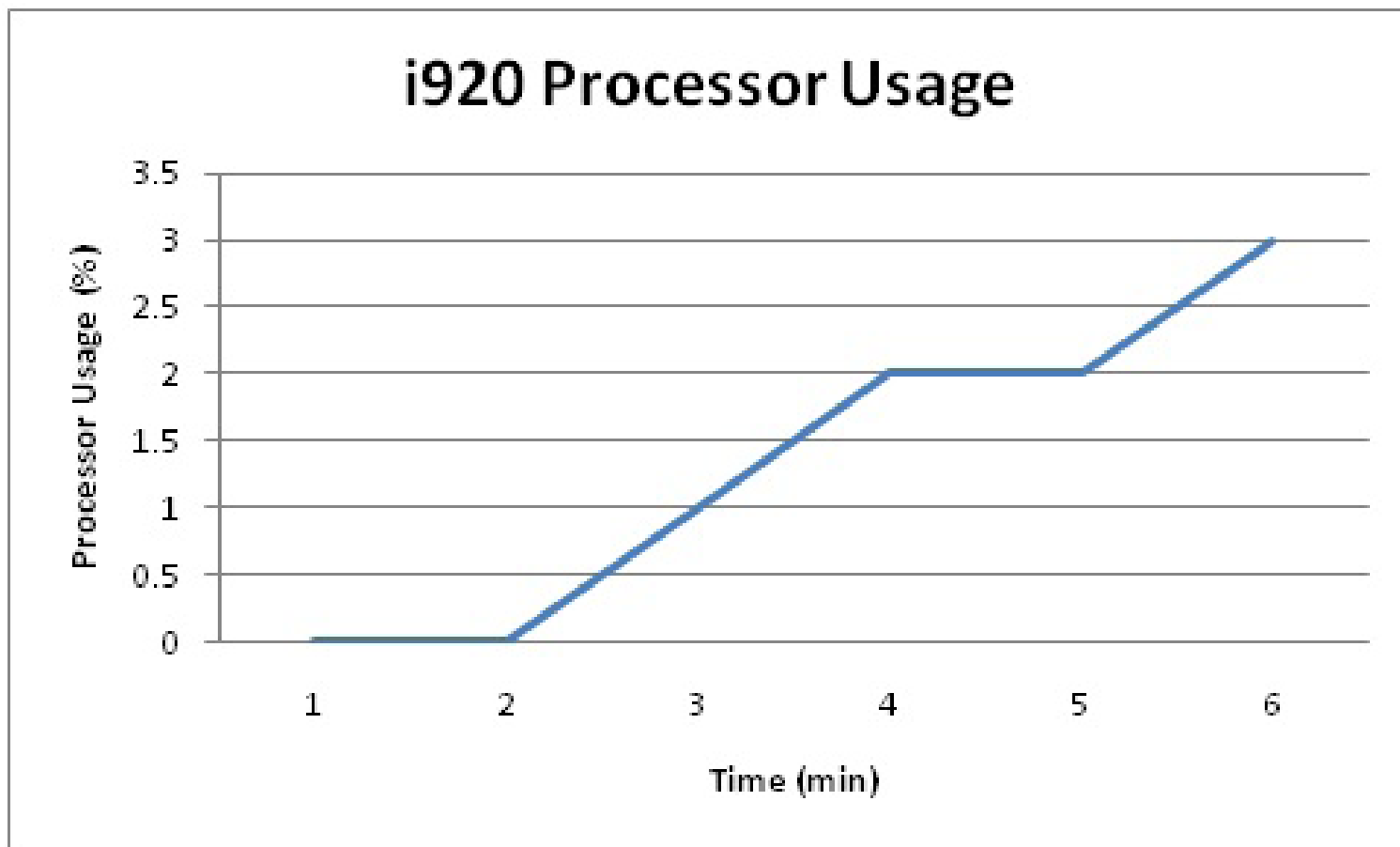
MapPoint: SSID = Guest



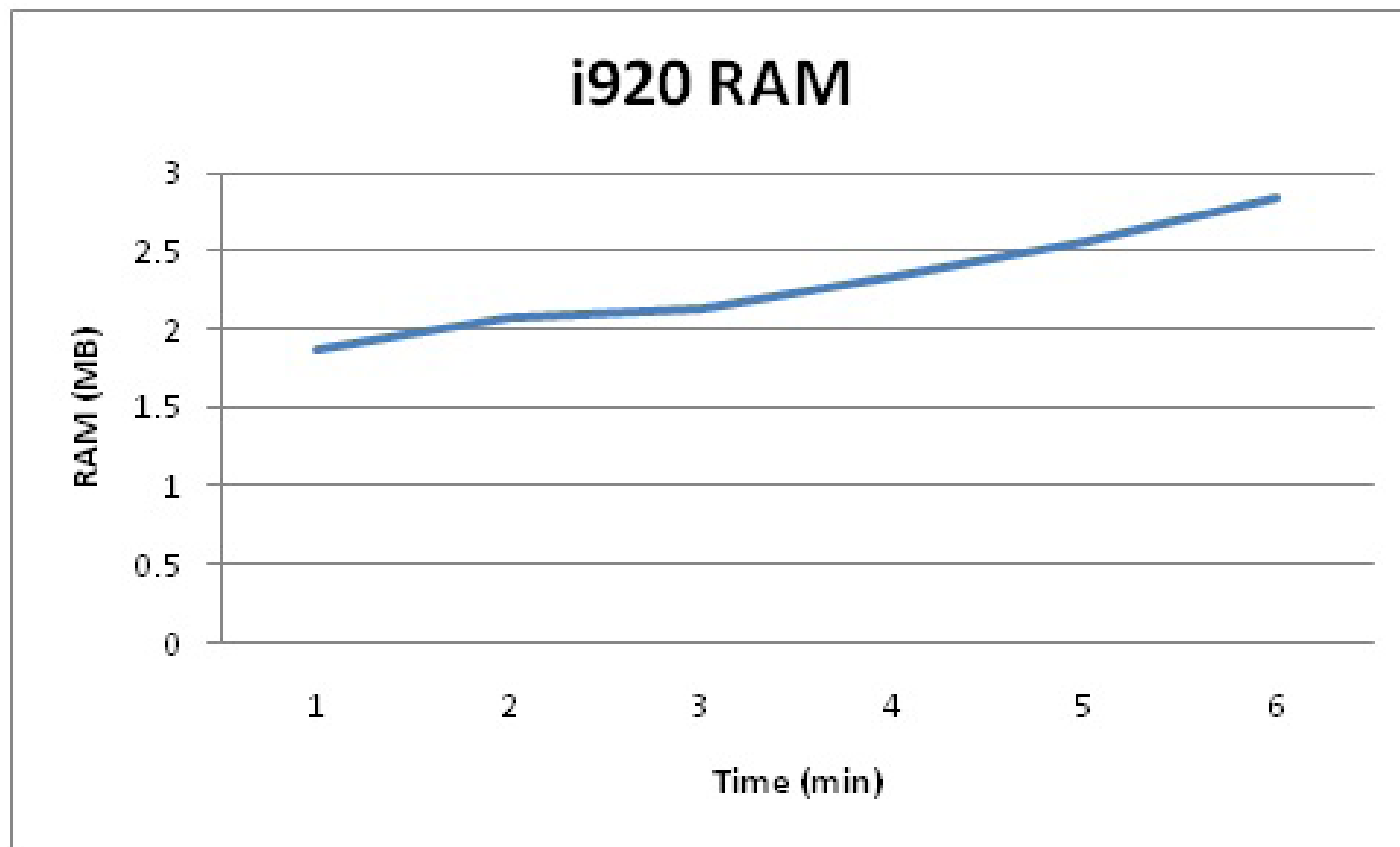
MapPoint: Engineering



CPU Usage



RAM Usage



Power Usage

- Power Usage - difficult to determine exactly, depends on scan frequency, upload frequency, device hardware.
 - I920
 - Baseline (Wi-Fi & GPS on) – 1980 minutes
 - 10s Wi-Fi Scan – 90 minutes – (96% decrease)
 - 60s Wi-Fi Scan – 500 minutes (75% decrease)
 - T-Mobile Wing
 - Baseline (Wi-Fi & GPS on) – 330 minutes
 - 10s Wi-Fi Scan – 60 minutes (82% decrease)
 - 60s Wi-Fi Scan – 180 minutes (45% decrease)

Future Work

■ MapPoint Restrictions

- Can only ever upload 1 master dataset at a time
- Maximum of 500 returned search items
- Maximum of 100 pushpins
- Maximum of 15 million cells (We use 8 cells per row which would limit us to 1.8 million rows. In an hour of aggressive scanning we collected 5,000 rows which would consume that limit in 350 hours.)
- Maximum of 100 MB compressed upload files
- Maximum of 2 GB per dataset uncompressed

Future Work

- Advanced data visualization
 - Will require internal data storage
 - Will require advanced data mining system
 - Will require advanced data graphing system



Future Work

- Diverse Mobile Platforms
 - Windows Mobile 6.x
 - Windows Phone 7
 - Android
 - Palm
 - iPhone

- Enhanced Security
 - SSL Mutual Authentication
 - User Anonymity

Conclusion

- OWMI as a proof of concept proved to be a success in proving that this type of data could be cataloged and searched.
- Most importantly the data with the desired characteristics such as open access points and signal strength is available to be catalogued and displayed in a visual manor to allow the user to quickly determine where they can acquire Wi-Fi access in public areas freely.
- We feel that through a combination of users, custom mobile device applications, and GIS visualization system it is very possible to map large portions of outdoor Wi-Fi information.