



GNSS and Umts Technology Demonstrator

GJU Workshop Brussels 5 and 6th of April 2006

GUTD Consortium



Company	Country	Role in Project						
Skysoft Portugal	Portugal	Prime contractor Skysoft will develop a simulator to validate the GUTD concept						
M3 Systems	France	 Partner Prototype development, testing and validation in VHDL to support the proof of concept Partner Investigation of the synergy algorithms between GNSS and UMTS Partner Support to the requirement elaboration and test plan definition 						
Universitat Politécnica de Catalunya Universitat politècnica De catalunya	Spain							
IMST GMBH	Germany							

GUTD Strategic Background of the Project



- The Galileo Navigation System aims at mass market applications
 - The diffusion of GNSS in mass market segment can be greatly improved by merging different positioning techniques into a single device
 - Only portable devices account for almost 75% of the total GNSS market, and added to the car navigation segment, this means targeting 96% of the total market size.

Different Positioning Systems

	UMTS	GNSS
Advantages	 Higher availability in urban environments In doors positioning Better resistance to multipath due to stronger signal 	 World coverage Higher position accuracy (~10-50 times better)
Challenges	 Worse position accuracy Worse performance in rural environments 	 Highly dependent on sky visibility Low signal power

GUTD Objectives



- To assess the degree of synergy between UMTS and Galileo in order to benefit from the two technologies to achieve greater position availability
- To study the current state of the art of the synergy algorithms and to analyze the inherent trade offs
- To develop a Simulator Framework that allows the Design, Validation and Testing of such device
- To implement a prototype model in a hardware description language that allows future integration into a single chip following the SoC (System-On-Chip) philosophy, paving the way to the integration of such capability into mobile devices
- To develop a Technology Transfer plan and disseminate the project results, e.g. Through a web site

GUTD Work Plan and Progress Status



D	Task Name	January Fut		0 un uil		l turn e	la de a		Cont	0.44	Name -	Decevel 1	
1	GITD Project	JanuaryFebru	aMarch	April	May	June	July	August	Septen	Octobe	Novemi	Decemi Jani	uaryFebrua
2	WP 0000 - Project Management												
3	WI 0.100 - Project Management											ľ	
4	VII 0.200 - Quality Management			1									
5	WP 1000 - Technical and Bibliographical Review												
6	WI 1.100 - GNSS Core Technology												
7	VII 1.200 - UMTS Core Technology												
8	VII 1.300 - UMTS-GNSS positioning state-of-the-art												
9	WP 2000 - Requirements Definition		-										
10	WI 2.100 - Interface/General Requirements		_										
11	WI 2.200 - GNSS Requirements												
12	WP2300 - UMTS Requirements												
13	VM 2.400 - UMTS Signal Generator Requirements		Ľь I										
14	WI 2.500 - VHDL Requirements		Č 🗗										
15	Requirement Consolidation Meeting	1	۱ 🐳	6-03									
16	WP 3000 - Detailed Design		-										
17	WI 3.100 - System Detailed Design												
18	VII 3.200 - GNSS Detailed Design			Ŭ.									
19	VVI 3.300 - UMTS Destailed Design			l 🍋	h.								
20	VVI 3.400 - UMTS Signal Generator Design				Ľ.								
21	VM 3.500 - Base-band synergy Algorithm Definition				<u>ن</u>								
22	VM 3.600 - PVT synergy Algorithm Definition				İ	By 1							
23	VM 3.700 - System synergy Algorithm Definition			Ľ.									
24	W 3.800 - VHDL Preliminary Design				(t i							
25	Critical Design Review Meeting					• 09	-06						
26	WP 4000 - Verification and Test Plan Definition					•	•						
27	VVI 4.100 - Completion and Verification Matrix												
28	WI 4.200 - Test Plan						ţ.						
29	VII 4.300 - Test Support Tools					Ļ							
30	WP 5000 - Implementation					-							
31	WI 5.100 - GNSS Implementation												
32	VM 5.200 - UMTS Implementation												
33	Midterm Review - Progress Assessment							♦ _111	-08				
34	VVI 5.300 - Algorithm implementation								_				
35	VVI 5.400 - Interface/High-level Software Implementation												
36	VVI 5.500 - UMTS Signal Generator Implementation							÷	1				
37	VVI 5.600 - VHDL Implementation										<u>م</u>	_	
38	VVI. 5700 - Unit Testing, Integration and Optimisation								¥				
39	VVI 5.710 - Matlab Code								-				
40	VVI 5.720 - VHDL Code										.		
41	WP 6000 - Test Execution and Review of Design												
42	VVI 6.1 UU - Matlab Code Testing												
43	WI 5.200 - VHDL Code Festing												
44	WP 7000 - Technology Transfer and Dissemination												1 01
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- The project is about to kick off
- The project duration is 12 months

GUTD Proposed Architecture



- GNSS and UMTS synergy at the receiver is studied at three levels
 - Baseband processing
 - Navigation solution
 - Assisted Positioning and end terminal



GUTD Challenges



- Scientific Investigation Challenges
 - Multipath mitigation techniques (note that although the signal is stronger in UMTS, then the multipath may affect more, and position error may increase if only the received power is contemplated)
 - Analysis of Automatic detection of signals under the Non-Line-Of-Sight condition
- Analysis of the similarities between UMTS and GNSS receiver architectures, focusing on the signal processing part
- Assisted GNSS to increase position availability
- Efficient and closed-form hybrid solutions, still capable of performing a weighted data fusion according with the quality of the received measurements
- Joint estimation of position and integrity, exploiting available measurement redundancy thanks to the synergy

GUTD Expected Results (1/2)



 Development of a Simulator Framework to allow the Design and Validation of Synergy Algorithms between GNSS and UMTS

The project aims at developing a Matlab® simulator where a system integrator, or manufacturer could design, implement and validate algorithms intended to merge the GNSS and UMTS systems.

Prototype Model of a Combined GNSS and UMTS Terminal

On the basis of the signal processing algorithms specification and their validation in the Matlab environment, the prototype model will be migrated into hardware description language (VHDL) and the algorithms and synergy algorithms (baseband level) validated. The assessment of hardware implementation feasibility and efficiency will allow to prepare future design of portable devices with merged technology capabilities.



<u>Results Analysis</u>

The test results of both the demonstrator and the model will be analyzed in order to assess the applicability and viability of the concept. This results in a list of recommendations and conclusions.

<u>Technology Transfer and Dissemination</u>

The technology transfer to the GNSS market main segment will be analyzed resulting in a technology transfer plan. Dissemination will be covered by numerous activities, including the development and implementation of the project website, as well as its respective dissemination to interested parties

GUTD Future Work



- To use the demonstrator in order to
 - Upgrade any upcomming UMTS position, or hybridisation, technique
 - Provide a toolset for internal investigation purposes, and design of receivers, taking advantage of the software flexibility and modularity to analyze the trade offs between different architectures
 - Taylor and use as validation tool set for testing a real receiver
 - the investigation of new synergy algorithms and assess their performance and impact on the overall system
- To use the prototype model as a first step to the integration in a single chip.
- Set-up a complete Hardware/Software environment modeling the whole GNSS/UMTS signal processing chains and allowing testing and validation of synergy algorithms at different levels of the architecture

GUTD Contact Details



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