Indoor positioning system based on ZigBee

**Preamble:**
Taking into consideration the growing industrial matter of wireless and RF/HF systems, SUPSI intends to deepen its own competences in the HF field. The acquired knowledge will be transferred from the research area to the teaching area thanks to specialized courses.

The need of using a ZigBee platform is given by an increased request by industry of wireless devices able to accomplish many tasks like: sensors network, remote keyless entry, indoor positioning, home and buildings automation, alarms & security systems, game controllers, etc.

Therefore TTHF proposes a consecutive master thesis with the objectives described below.

**Project goals:**
Develop a radio localization system composed by a wireless sensors network able to detect the position of every network node and display graphically the results on a PC.

**Tasks description:**
1. Wireless localization state-of-art study;
2. ZigBee protocol analysis
3. Localization algorithms study and development
4. Wireless signal propagation analysis, measurement and simulation (WinProp)
5. Antenna Design
6. Platform development for first hardware test and demonstrations
7. GUI development
8. Technical documentation

**Application fields and future developments:**
1. Any application involving low distance indoor localization field can take advantage through this application.

**Software:**
- Ansoft Designer (HF circuits development and simulations tool)
- Ansoft HFSS (2D and 3D electromagnetic waves simulator)
- WinProp

**Technical skills:**
Basic knowledge in wave propagation theory, and above all, interest in deepening the study of high frequency systems.
The school and the laboratory:
The “Scuola Universitaria Professionale della Svizzera Italiana” is the University of Applied Sciences of Southern Switzerland and is mainly located in the surroundings of Lugano, the main town of the Italian-speaking canton Ticino. The overarching goal of SUPSI is the promotion of technological development and technological transfer. SUPSI consists of five departments and three institutes. Besides basic education, SUPSI offers postgraduate courses and contributions in applied research to local, national and international companies. SUPSI consists to date of about 2000 students and 300 staff members (professors and lecturers, assistants, technical and administrative officers). SUPSI institutes and laboratories successfully participated in a number of EU projects and within the special research actions EUREKA, IMS, MEDEA, DGVII.

Moreover, SUPSI is funded through regular national programs (CTI, FNSRS, MICROSWISS) and through direct applied-research grants from industry.

Among the applied research facilities, the High Frequency and Wireless Communication Systems Group of SUPSI offers a broad range of services in both applied research and technological transfer in all fields related to high-frequency systems and to metrology.

The TTHF’s staff consists today in 15 experienced engineers developing concrete industrial projects.

In past and present projects, the activities covered high-frequency discrete components based implementation of electronics circuits (e.g. for Satellite Receivers), the development of microwave systems (e.g. telecom and for material characterization) and the design of high performance antenna. Other research activities are in the metrology area of telecommunication systems with particular interest for the NIR (Non Ionizing Radiation): wireless signal measurement protocols have been defined, verified and applied.

More broadly, the TTHF group can count on competence in:

- Wireless sensors and wireless communication system design
- RFID tags, readers and systems design
- GNSS (GPS and Galileo) systems design
- Metrology and simulation of Non Ionizing Radiations (NIR)
- Low power RF telecommunication systems design

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