Abstract

The most common form of information processing takes place on high power computing devices, from tablet modern mainframes. In most applications, such as office applications, these devices are used to process information that is centered on the user (man control system), but is indirectly related to the physical environment. Processing is also used to exercise control over physical processes, for example, during control of mechanical processes in a factory for correct direction and speed, resulting the processing step integrated with the control, equivalent to processing built into the physical. These integrated systems are generally based on human interaction, but the interface is designed to be controlled at any time by a human user. Such integrated systems are devices with low power consumption and have enough computing power for their tasks. Their impact on daily life continues to grow very quickly. Almost in every house, embedded processing is present to control a microwave, a washing machine or a real mobile phone. The actual progress of technology is about to take the embedded control from our daily lives a step further. There is a predilection to equip smaller objects, even dispensable supplies with embedded technology; also, the living spaces can be provided with such capabilities. Lastly, computation will enclose us in our daily lives, realizing a vision of ―low power – brain power‖ where many low power devices will gather and process information from different sources to both control processes (brainpower) and to interact with human users. By integrating computation and control in our physical environment, the interaction paradigms of man-to-man, man-to-machine and machine-to-machine can be supplemented, in the end, by a notion of user to physical world; the contact between user and physical world becomes more important than data manipulation.

The concept of mobile sensor network consists of three terms, each belonging to a vector of current development: network, sensors and mobility. The network term refers to the communication, and how much it mattered and matters to society is widely appreciated. Sensors, in turn, send the measurement of parameters on which to perform various actions. Basically, without their diversity and accuracy, today would not exist a multitude of equipment that we "raise the quality of life". Also, the property of mobility is becoming more widespread and is, I think, one of the terms that highlight the potential beneficiaries. At first look, we could put equality between wireless sensor networks (WSN) and mobile sensor networks (MSN), what happened with many authors. However, MSN is a category of WSN. Basically, if we divide the WSN, it will result in WSN with static topology and WSN with dynamic topology. MSN could be the second category. MSN constraints in rapport with static WSN from the need for lower power consumption, a better use of channel capacity, improve coverage sensory and communication, and tracking of objects. Starting from the three vectors, we can say that their resultant is intended to bring a greater contribution to the development of future technologies.

One of the major challenges to design efficient Wireless Sensors Networks (WSN) is the scarcity of energy, coverage, dimensional and computational resources. We address this problem with particular reference to algorithms for efficient decentralized trajectory planned constrained by routing algorithm and coverage area, for minimizing node dimensions using pseudo-fractal multi-band antenna (practical for cognitive radio).

Distributed trajectory planned schemes provide algorithms that exploit the benefits of decentralized algorithms to reduce the amount of information transmitted in the network. A study is herein carried out along with an implementation of the previously mentioned algorithms with the Matlab environment. The efficiency of the decentralized algorithms is then tested by means of simulations. We also investigate and extend the energy-aware medium access S-MAC with cross-layer optimizations plus data gathering algorithms (like: data selection and compression), optimal transmit power and channel coding methods, which can be placed on the same stack with the previous decentralized algorithm. In this context, we investigate performances of the MSN in terms of time average to reach a goal, coverage are, physical dimensions and power consumption where a detailed decentralized trajectory planning and pseudo fractal antenna descriptions are taken into account. We characterize the MWSN problems by means of optimization problems. This allows us to propose new solutions to increase the radio coverage area, to reduce power consumption. As a relevant part of our work, an application filed has been indentified and a platform has been set up by using the mobile robots with radio capabilities, along with a Matlab application, for the proposed algorithms.

The seven years experience working in the sensor networks and real time operating systems field, led me to reconsider the thesis in terms of practical approaches, accessible, so it can serve for both new development studies and existing architecture integration.

The main objectives of the thesis are:

Defining MSN optimization criteria

Propose new structures and techniques to optimize specific MSN criterions;

Description and acquiring suitable techniques to develop and implement optimized structures and optimal algorithms for MSN;

Studying both hardware and software mobile sensor networks architecture;

Identifying a field of application for which to develop an original solution;

Finally, I hope that we managed to reach goals that reading this thesis can bring specialists interested, and, last but not least, it brings new in an area that is growing rapidly. I also want to continue my research into appropriate themes that have opened in this work.

Looking back, I am amazed and at the same time very thankful for all I have received throughout these three years.

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