6. Conclusion

In this thesis we have presented the results of an extensive measurement analysis on mica2 and mica2dot Berkeley motes. This analysis was aimed at investigating the main elements that characterize the sensor network performance, e.g., impact of weather conditions on the transmission range, energy consumption in different operating conditions, etc. To this end the experiments were done in an outdoor environment under various atmospheric conditions.

The main results of this experimental analysis are summarized in Table 6-1.

	mica2	**mica2dot**
Available throughput	4.6 Kbps	4.6 Kbps
Power Consumption		
Reception	16mA	12mA
Transmission	18mA	14mA
Computation (processor only)	8 mA	8 mA
Power down mode	10 uA	10 uA
Transmission range		
with normal weather conditions	55 m	135 m
with fog/rain	10 m	
with maximum tx power (normal weather conditions)	70 m	230 m
Minimum ground distance	1 m	1 m
Minimum horizontal distance	50 cm	50 cm
Carrier sensing range		275 m

Table 6-1. Summary of the main experimental results.

Although the analysis is strictly related to a specific technology (i.e., Berkeley motes) we nevertheless think that the results obtained still provides general useful information. We found that the transmission range of mica2/mica2dot sensor nodes significantly decreases in the presence of fog or rain. In addition, we found that there is a minimum distance from the ground at which sensor nodes should be set.

We also evaluate the physical carrier sensing range that is approximately twice the transmission range and is independent from the rate at which data are transmitted.

In addition we have found that the overhead introduced by TinyOS operating system is almost negligible with respect to transmission time.

Finally indoor tests have shown that motes have different behaviors according to the wall composition. This is because electromagnetic waves are reflected by materials thus there is an attenuation of signal.

These aspects need to be taken into account for a correct deployment of sensor nodes. Based on our experimental results, we also derived a channel model for the CSMA/CA MAC protocol used in motes. This model is very similar to the IEEE 802.11 channel model. Since many simulation studies on sensor networks assume the IEEE 802.11 CSMA/CA protocol to characterize the physical and data link layers, our findings prove that this choice can be considered as acceptable, at least as far as the channel model is concerned.