
Contents

Introduction	vii
Chapter 1. Wireless Power Transfer Applied to NFC	1
1.1. Introduction	1
1.2. Theoretical background	4
1.3. NFC systems	7
1.3.1. Reader model	7
1.3.2. Tag model	9
1.3.3. NFC system model	13
1.4. NFC constraints	14
1.4.1. Antenna design	14
1.4.2. Coupling coefficient (k)	18
1.4.3. Quality factor (Q)	19
1.4.4. Efficiency (η)	21
1.4.5. Average magnetic field (H_{av})	22
1.4.6. Environmental effects	22
1.5. NFC simulation and measurement	23
1.5.1. Magnetic field (H_{AV})	24
1.5.2. Coupling coefficient (k)	27
1.5.3. Presence of metal near the antenna	29
1.5.4. Energy harvesting	31
1.5.5. Backscattering measurement	34
1.5.6. NFC IC comparison	36
1.5.7. Antenna dimensions	43

Chapter 2. Case Study 1: Soil Moisture Sensor	47
2.1. Motivation	47
2.2. Soil moisture measurement techniques	48
2.3. System description.	50
2.3.1. System overview	50
2.3.2. Volumetric water content	52
2.3.3. Software	60
2.4. Experimental results.	63
2.4.1. Calibration.	63
2.4.2. Irrigation.	65
2.4.3. Comparison against commercial sensor.	66
Chapter 3. Case Study 2: Smart Diaper	67
3.1. Motivation	67
3.2. Capacitive moisture detection	68
3.3. Capacitance simulation	72
3.4. Experimental results.	78
3.5. Comparison with other technologies.	85
Chapter 4. Case Study 3: NFC Sensor for pH Monitoring	89
4.1. Motivation	89
4.2. System description.	91
4.2.1. System overview	91
4.3. Signal processing	94
4.4. Experimental results.	95
4.5. App and cloud storage.	101
Chapter 5. Case Study 4: Fruit Ripeness Sensor	103
5.1. Motivation	103
5.2. System overview.	104
5.3. Experimental results.	105
5.4. Mobile app	117
List of Acronyms	121
References	125
Index	145