

Contents

List of Figures xv

List of Tables xxi

Part I Preliminaries

1 Introduction 3

1.1 Pervasive Social Computing 3

1.2 Defining Social Context 5

1.3 Research Challenges 7

1.3.1 Consistent Representation of Social Context Information 8

1.3.2 Reasoning About Meaningful Social Context Information 9

1.3.3 Managing Access Control and Adaptation 9

1.4 Approach Overview 10

1.4.1 Social Context Modelling 11

1.4.2 Social Context Reasoning 11

1.4.3 Social Context Management 12

1.5 Statement and Contributions 12

1.6 Book Structure 13

2 Application Scenarios 17

2.1 A Data-Centric Socially-Aware Application Scenario 18

2.1.1 The Phone Call Interruptions 18

2.1.2 Requirements Analysis 19

2.2 An Interaction-Centric Socially-Aware Application Scenario .. 20

2.2.1 The Cooperative Convoy 20

2.2.2 Requirements Analysis 22

2.3 Requirements for Developing Socially-Aware Applications... 23

2.4 Summary 25

3	Background and Related Work	27
3.1	Ontology Preliminaries	28
3.1.1	Ontology Definitions	28
3.1.2	Languages for Encoding Ontology	29
3.1.3	OWL DL Constructs for Representing Knowledge	31
3.2	Context Modelling Approaches	32
3.3	Ontology-Based Context Models	37
3.4	Ontology-Based Event Models	38
3.5	Situation Specification and Reasoning	38
3.6	Privacy Policy Models and Access Control	40
3.7	Managing Social Context Information	40
3.8	Modelling and Managing Runtime Social Interactions	41
3.9	Platform for Collaborative (Social) Interactions	42
3.10	Platform for Runtime Adaptation	43
3.11	Summary	44

Part II Social Context Modelling, Reasoning and Management

4	Social Context Modelling	49
4.1	Modelling Approach	49
4.2	Social Context Upper Ontology	53
4.3	Domain-Specific Social Context Ontologies	57
4.3.1	The <i>Social Role</i> Ontology	57
4.3.2	The <i>Connection-Oriented</i> Social Relationship Ontology	59
4.3.3	The <i>Interaction-Oriented</i> Social Relationship Ontology	65
4.3.4	The <i>Situation</i> Ontology	69
4.4	Summary	70
5	Social Context Reasoning	73
5.1	Reasoning Approach	73
5.2	Deriving Social Relationships	75
5.2.1	Deriving <i>Family</i> Relationships	75
5.2.2	Deriving <i>Friend</i> Relationships	76
5.3	Deducing and Abstracting Situations	77
5.3.1	Deducing Situations	77
5.3.2	Abstracting Situations	82
5.4	Inferring Situations from Interaction Events	83
5.4.1	Interaction Event Upper Ontology	85
5.4.2	Domain-Specific Interaction Event Ontology for Cooperative Convoy	86
5.4.3	Domain-Specific Interaction Event Ontology for Facebook	88
5.4.4	Examples of Interaction Event	91

5.4.5	Interaction Event Based Situation Specification	91
5.4.6	Human-Readable Situation Specification Language . . .	92
5.4.7	Situation Inference Example	94
5.5	Summary	95
6	Social Context Management	97
6.1	Managing Access to Social Context Information	97
6.1.1	A Socially-Aware Access Control Policy Model	98
6.1.2	Policy Specification and Inconsistency Detection	100
6.1.3	Policy Enforcement in Accessing Social Context Information	102
6.2	Modelling and Managing Social Interactions	103
6.2.1	Modelling Social Interactions	104
6.2.2	Managing Runtime Adaptation	117
6.2.3	Adaptation Across Social Interaction Models	123
6.3	Summary	127
 Part III Platform Implementation, Case Studies and Evaluations		
7	<i>SocioPlatform Architecture and Implementation</i>	133
7.1	Architecture and Design of the SCIM	134
7.1.1	Information Acquisition Interface	135
7.1.2	Designing Adapters to Fetch Raw Data	137
7.1.3	Fetching and Processing Raw Data for Consistent Social Context Information	138
7.1.4	Policy Interface	138
7.1.5	Query Interface	139
7.1.6	Rule Interface	141
7.2	SCIM Prototype Implementation	142
7.2.1	Implementing Ontologies	142
7.2.2	Implementing Adapters	143
7.2.3	Implementing Rule APIs and Reasoning Module	145
7.2.4	Implementing Policy APIs and Privacy Policy Module	149
7.2.5	Implementing Query APIs and Query Processing Module	150
7.3	Architecture and Design of the SIM	151
7.3.1	The Model Execution Module	152
7.3.2	The Management Module	153
7.4	SIM Prototype Implementation	154
7.4.1	Implementing the Model Execution Module	156
7.4.2	Implementing the Management Module	159
7.4.3	The Deployment Layer	161

7.4.4	Composing Runtime Social Interaction Models Using SIMbuilder	161
7.4.5	Generating and Providing Interaction Events	163
7.5	Summary	165
8	Case Studies: Social Context-Aware Mobile Applications	167
8.1	Design and Implementation Process	168
8.2	Case Study #1: The <i>SPCall</i> Application	169
8.2.1	Design Goals and Constraint	170
8.2.2	Design Features	171
8.2.3	Design Process	172
8.2.4	Implementing <i>SPCall Client</i> for Android	174
8.2.5	Acquiring Social Context Information and Populating Knowledge Base	176
8.2.6	Reasoning About Social Context Information	178
8.2.7	<i>SPCall</i> Use Scenarios	179
8.3	Case Study #2: The <i>SocioTelematics</i> Application	180
8.3.1	Design Goals and Design Constraints	181
8.3.2	Design Features	181
8.3.3	Design Process	182
8.3.4	Instantiating Models and Creating Runtime Environment	187
8.3.5	Implementing <i>SocioTelematics</i> Client for Android	187
8.3.6	<i>SocioTelematics</i> Use Scenarios	190
8.4	Summary	194
9	Experimental Evaluations	195
9.1	Experimental Setup	196
9.2	Evaluating <i>SCIM</i>	196
9.2.1	Performance Evaluation for Information Acquisition ..	197
9.2.2	Performance Evaluation for Description Logic Based Reasoning	201
9.2.3	Performance Evaluation for Query Processing	201
9.2.4	Performance Evaluation for Interaction Event Stream Based Situation Reasoning	202
9.3	Evaluating <i>SIM</i>	204
9.3.1	Quantifying Adaptation Overhead	204
9.3.2	Evaluating Resource Consumption and System Performance	206
9.4	Evaluating the <i>SocioTelematics</i> Application	209
9.4.1	Evaluating Resource Consumption	211
9.4.2	Quantifying Performance	211
9.5	Evaluating the <i>SPCall</i> Application	213
9.5.1	Evaluating Resource Consumption	213
9.5.2	Quantifying Performance	216
9.6	Summary	217

10 Conclusion	219
10.1 Contributions	219
10.2 Future Work	223
A Description Logic-Based Reasoning Rules and Constraints	225
A.1 Classification and Reasoning Rules	225
A.2 Constraints	230
A.2.1 Constraints Defined in <i>SACOnto</i>	231
B Social Interactions in a Cooperative Convoy	233
C Social Interaction Models	241
C.1 Domain-Centric Social Interaction Models (DSIMs)	241
C.1.1 ConvoyDSIM	241
C.1.2 BudgetDSIM	243
C.1.3 AVISDSIM	246
C.2 Player-Centric Social Interaction Models (PSIMs)	249
C.2.1 Car#1PSIM	249
C.2.2 Car#2PSIM	252
D Rule Translation Script (<i>RuleTrans.dsl</i>)	257
E Schema Definitions	261
E.1 DSIM Schema	261
E.2 PSIM Schema	265
References	271

Pervasive Social Computing
Socially-Aware Pervasive Systems and Mobile
Applications

Kabir, M.A.; Han, J.; Colman, A.

2016, XXII, 282 p. 91 illus., 79 illus. in color., Hardcover

ISBN: 978-3-319-29949-5