

Maneesh Rao

Internet of Things with Raspberry Pi 3

Leverage the power of Raspberry Pi 3 and JavaScript
to build exciting IoT projects



Packt

Table of Contents

Preface	1
Chapter 1: Introduction to IoT	7
Understanding IoT	7
Defining IoT	7
Architecture of an IoT ecosystem	8
History and evolution	13
IoT-applications and future prospects	14
Summary	16
Chapter 2: Know Your Raspberry Pi	17
Understanding Raspberry Pi 3	18
Important features of Raspberry Pi 3 Model B	19
Setting up Raspberry Pi	23
Connecting to the internet	27
Setting up headless Raspberry Pi	29
Summary	33
Chapter 3: Let's Communicate	35
The internet	35
The rise of JavaScript and Node.js	37
Node.js	37
Advantages of using Node.js for IoT	38
HTTP	39
Implementing HTTP	40
HTTP server	41
HTTP client	44
MQTT	47
MQTT architecture	48
MQTT message types	49
MQTT topics	49
QoS levels	50
Last will and testament	50
Retained messages	50
Persistent sessions	51
Keep alive message	51
MQTT brokers	52
MQTT implementation	52
MQTT broker	52
MQTT client	54

Summary	60
Chapter 4: Weather Station	61
Sensors	62
Temperature sensor DS18B20	62
DHT11 humidity sensor	64
Weather API	65
Google sheets	68
Summary	85
Chapter 5: Controlling the Pi	87
L293D	87
DC motor	89
Light-emitting diode	89
Summary	102
Chapter 6: Security Surveillance	103
Infrared sensors	103
Types of IR sensors	104
Ultrasonic sensors	112
Buzzer	116
Raspberry Pi camera module	117
Wiring up	118
Interfacing PIR sensor module HC-SR501	118
Interfacing an active IR sensor	119
Interfacing an ultrasonic sensor HC-SR04	120
Interfacing an LED	121
The code	124
Camera module code	124
Email module code	127
Sensor module code	130
Summary	136
Chapter 7: Image Recognition	137
Understanding image recognition	137
Deep learning	138
How image recognition works	139
Gathering data	140
Organizing data	142
Building a predictive model	142
Recognizing an image	143
Amazon Web Services	143
AWS S3	144
AWS Rekognition	147
Identity and access management	149

Command line interface	153
Implementation	154
Create collection	155
Upload reference image	156
Face comparison	158
Wiring up	159
Interfacing IR sensor	159
Interfacing LEDs	160
Interfacing the Pi camera module	160
The code	160
Index face module code	161
Search face by image module code	164
S3 bucket module code	165
Camera module code	168
Upload reference image module code	171
Compare image module code	172
Summary	175
Chapter 8: Bot Building	177
Car chassis	178
Pulse-width modulation	179
Analog signal	180
Digital signal	181
Wiring up the bot	183
Wiring L293D with motor	183
Wiring L293D with Raspberry Pi	184
Forward movement	187
Reverse movement	187
Right turn	188
Left turn	188
Stop	188
Speed control	189
Executing the commands	193
Summary	199
Chapter 9: Security in IoT	201
The challenges in providing IoT security	202
Security in endpoint devices – constrained devices	202
Authorization and authentication	202
Device firmware upgrade	202
Secure communication	203
Data security	204
High availability	204
Identifying cyber attacks	205
Absence of standards	205
Ignorance from customers and manufactures	206

Table of Contents

Trends and challenges in specific industries	206
Automotive industries	206
Smart homes and buildings	207
Securing Raspberry Pi	208
Changing the default password	208
Changing the username	211
Making sudo require a password	213
Improving SSH security	214
Username and password security	214
Key-based authentication	214
Setting up a firewall	221
Fail2Ban	226
Summary	227
Other Books You May Enjoy	229
Index	233
