

Table I Extensibility assessing CRNT+ for adding components.

Add Readers components			
Step	Minimum lines of code	Other complexities	
1. Extend Module class	3	Further subclassing	
2. Extend ReaderClass class	13	Depending on sensor	
3. Add Module class definition	1	None	
4. Add ReaderClass class definition	1	None	
Add Writers components			
Step	Minimum lines of code	Other complexities	
1. Extend OutputModule class	7	None	
2. Extend OutputClass class	13	None	
3. Add Module class definition	1	None	
4. Add OutputClass class definition	1	None	
Add User Interface components			
Step	Minimum lines of code	Other complexities	
1. Extend GUIInputModule class	12	None	
2. Extend MyTabActivity class	13	Retrieve GUIInputModule	
3. Create icons	0	None	
4. Create layout xml file	3	Depends on GUI structure	
5. Create drawable xml file	6	None	

Estimations indicate the smallest effort. For functional components, actual effort can be larger.

2.6 Experimental evaluation

2.6.1 Epilepsy evaluation study

We evaluated the CRNTC+ framework in a case study to investigate data acquisition from multi-modal on-body sensors and recognising seizures. Since epileptic seizures often occur only sporadically in patients during daytime, two expert actors were asked to simulate five different seizures types (myoclonic, tonic, tonic-clonic, clonic, myoclonic tonic-clonic) during ten everyday activities, including lying in bed, getting dressed, scratching, drinking from a glass, brushing teeth, sit-ups, shaking hands, using mouse, typing on a keyboard, folding towels. Heart rate data were acquired using a Shimmer⁵ electrocardiogram (ECG) module, placed at the left upper arm. The module featured a 3D accelerometer too. Disposable electrodes were connected to the ECG module and attached to the participant's chest. Respiratory data were acquired using a Braebon⁶, strap, placed around participants' thorax and connected to a second Shimmer ECG module. Another 3D accelerometer was placed at the right upper arm. Two full inertial motion units (one ETHOS and one Shimmer 9DOF) were placed at participants' left and right wrists. Data was acquired at two different sampling rates: for the Shimmer units 100 Hz, and for the ETHOS sensor 128 Hz. All the sensing modules were hold in place using adjustable velcro straps. Data from all sensors was recorded via Bluetooth (Shimmer) and ANT (ETHOS) using a Sony Ericsson Xperia active smartphone. A study observer was carrying the phone and used ACTLog to

⁵ Shimmer, <http://www.shimmer-research.com>

⁶ The Braebon Respiratory Effort Sensor, <http://www.braebon.com>