ABSTRACT

As the idea of location awareness has already matured and numerous applications are flooded in today’s world, the logical next step reasons out, to context-awareness. Though the idea of context-awareness has been in the research field for close to two decades, the recent advancement in Internet of Things has brought a more compelling thrust in its research. Sensor networks integrating billions of sensors and actuators will be prevalent in the near future producing big data. Filtering and analysing this data with the contextual information will yield more significant results. But deducing the context information itself poses many challenges and unresolved research problems. Context-awareness systems involve acquiring, analysing, reasoning the data and composing the services for suitable action. Service composition either by orchestrating or choreographing technique has been deployed in certain applications, however, each domain requires unique methodology. Healthcare has always been the top priority when it comes to applying novel technologies. Applying context-awareness computing in the healthcare service sector is of paramount importance.

The problem context for this research lies in a cardiology speciality hospital’s Intensive Therapy Unit or the post-surgery recovery ward which has lot of scenarios emanating that involves course of actions to be delivered by the healthcare professionals depending on the context. Depending on mere human service may not be adequate. With the available advancements in technologies, it would be possible to leverage optimum service in that time critical situations, provided technology can sense the changes in context
and act accordingly. The course of actions to be taken involves an amalgamation of understanding the location, presence availability, relevance of and coordination among various departments, machines and personnel. This can be summarized as “Response” with “Context-Awareness”. The primarily task is to sense the context and then determine and locate the relevant services, which are distributed in the World Wide Web, to achieve a goal situation as a solution to the problem. In order to deliver such a solution we need to develop an exclusive context-aware framework. The existing frameworks will not be adequate to meet such a demanding situation and hence, the research problem is to evolve a comprehensive service composition framework for smart healthcare systems.

In order to solve this problem, a use-case approach was followed. After identifying an appropriate use-case, the solution was first modelled using Automata. The concept of service automata and timed automata were fused to deliver a timed-service automaton which is appropriate to model and test the framework and algorithm for service composition.

As a solution to the research problem, a composition based framework of a context-aware smart healthcare system has been presented. It will guide software developers to deploy services for critical healthcare, under the umbrella of Service Oriented Architecture. The matured concept of Automata has been tweaked to present novel timed-service automata which will enable service composition precisely for meeting the time constrained demands of modern healthcare service requirements. It has been tested with UPPAAL verification tool for validity and concurrency. A prototype has
been implemented to study the validity of the established framework. Apache JMeter tool was used to test the strength of the services and engine developed based on the proposed algorithm for effective service composition.