A PERVASIVE FRAMEWORK FOR IDENTIFYING ACTIVITY PATTERNS OF MOBILE USERS AND PREDICTING ACTIVITIES

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M.Sc. in Computer Science

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This report is submitted in partial fulfillment of the requirements for the Degree of Master of Science in Computer Science specializing in Mobile Computing

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DECLARATION

I declare that this is my own work and this report does not incorporate without acknowledgement any material previously submitted for the degree or diploma in any other university or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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I certify that the declaration above by the candidate is true to the best of my knowledge and that this report is acceptable for evaluation for the CS-5999 PG Diploma Project.

Name of the supervisor: Dr. Indika Perera

Signature of the supervisor: ………………..   Date: ………………………

ABSTRACT

Smartphones has become one of the most used devices in day to day life. Even though they already have so many features, they still lack the ability to identify user's context and the intentions. This is important for improving user experience and make existing mobile application more user friendly. The issue is that there is no underlying support either from operating system or software level to predict the user's intensions based on user context.

The main objective of this research is to come up with a framework to predict user intentions based on user context by identifying activity patterns. The framework must be run in-device so that it will function irrespective of the network connectivity.

We selected "clustering" as the approach because it does not involve high computation power or complexities to run in-device. We identify activity patterns by clustering the user's actions and then predict based on the closest cluster for the given time. We have evaluated K-means and Expectation-maximization (EM) clustering algorithms for compatibility for the framework. Unlike computers, mobile devices do not have powerful CPUs or memory. Therefore, we measured CPU time and memory usage of these algorithms to select the best. To maintain low-end device compatibility, we tuned in the algorithm parameters to achieve high accuracy keeping the CPU and memory consumption in low levels.

In conclusion, we have successfully identified that EM clustering is suitable for high-end devices and it gives high accuracy while K-means is suitable for low-end devices with acceptable accuracy. We have implemented the framework as an Android library and developed a proof of concept application by embedding the implemented library to show that this research will actually enables application developers to give better user experience to their applications.

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List of Abbreviations

Abbreviation	Description
IoT	Internet of Things
HMM	Hidden Markov Model
MSE	Mean Square of classification Error
NN	Neural Networks
KNN	K-Nearest Neighbors
ECA	Event-Condition-Action
GPS	Global Positioning System
API	Application Programming Interface
SDK	Software Development Kit
IDE	Integrated Development Environment
App	Mobile Application
EM	Expectation-Maximization