

# IoT based Human Centric Context Awareness Framework for Healthcare and Wellness Platform

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**Abstract**— In recent years, healthcare and wellness platforms are developed rapidly with the advent of smart devices which possess diverse sensors. Existing systems are limited to provide simple health status visualization services from single device or single sensor, which make them unable to provide timely high quality services. This paper proposes Human Centric Awareness Framework based on diverse IoT devices to provide high quality services timely.

**Keywords**— human behavior; context awareness; machine learning; ontology

## I. BACKGROUND

Context aware technologies are advancing and therefore leading to the increase in services built on top of it. Mining Minds platform [1] is one such platform that is utilizing the recognized context of the user to provide diverse services. Context recognition process is handled at the Information Curation Layer (ICL) [2], that divides it into low level and high level context. Low level context includes the context recognized from the sensory devices, smartwatch, camera, and smartphone. The low level context is based on activities (walking, running, sitting, and others), location (home, office, gym, and others), emotion (happy, sad, anger, and others), and food (rice, burger, meat, and others) recognition. These high level activities are utilized by the high level context (amusement, exercise, commuting, and others in activities [3], and grain, carbohydrate, fats and others in nutrition services) to recognize context on top of the low level context. Both the high level and low level context is used by the Service Curation Layer (SCL) for the generation of the services.

## II. HUMAN CENTRIC CONTEXT AWARENESS FRAMEWORK

The proposed Human Centric Context Awareness Framework is hierarchically structured model able to recognize low-level (LLCA) and high-level context (HLCA) with heterogeneous sensor data such as smartphone, smartwatch and 2D camera. LLCA recognizes various human real-life context such as physical activities, emotion status, locations and food intake from various sensors. HLCA recognizes accurate high-level context based ontological model with extracted low-level context. LLCA recognize 9 physical activities, 4 emotions and 5 locations and HLCA recognize 9 behavioral context and 3 nutrition context.

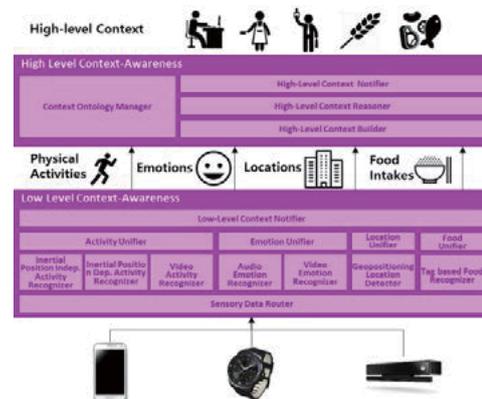


Figure 1 Human Centric Context Awareness Framework

## III. CONCLUSION AND FUTURE WORK

This paper proposes IoT based Human Centric Context Awareness Framework by using various devices and sources in real-time manner. In the future, we are planning to enhance accuracy of existing modules and extend the number of input d, such as physiological sensor and smart cup.

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## REFERENCES

- [1] Banos, O., Bilal Amin, M., Ali Khan, W., Afzel, M., Hussain, M., Kang, B. H., Lee, S. "The Mining Minds Digital Health and Wellness Framework. BioMedical Engineering OnLine", vol. 15, no. 1, pp. 165-186, 2016
- [2] Banos, O., Villalonga, C., Bang, J., Hur, T., Kang, D., Park, S., Huynh-The, T., Le-Ba, V., Bilal Amin, M., Asif Razzaq, M., Ali Khan, W., Hong, C. and Lee S. "Human Behavior Analysis by Means of Multimodal Context Mining", Sensors (SCIE, IF: 2.033), Vol.16, Issue 8, 980, 2016
- [3] Villalonga, C., Asif Razzaq, M., Ali Khan, W., Pomares, H., Rojas, I., Lee S., and Banos, O. "Ontology-Based High-Level Context Inference for Human Behavior Identification", Sensors (SCIE, IF: 2.033), Vol.16, Issue 10, 1617 2016