ISSN: 2321-7782 (Online)
e-ISJN: A4372-3114
Impact Factor: 6.047

Volume 5, Issue 2, February 2017

International Journal of Advance Research in Computer Science and Management Studies

Research Article / Survey Paper / Case Study

Available online at: www.ijarcsms.com

# A Survey on Framework for Context Awareness Using Smartphone

**K. H. Walse**[1]
Asst. Professor, Dept of Computer Science and Engineering
Anuradha Engineering College
Chikhli – India

**Vrushali G. Joshi**[2]
M.E. 2nd Year, Dept. of CSE
Anuradha Engineering College
Chikhli – India

**Dr. R. V. Dharaskar**[3]
Director
MPGI Group of Institutions Integrated Campus
Nanded – India

***Abstract:*** ***Human activity recognition is the most recently introduced and nowadays widely used term. Human activity recognition is a big research point. Many researchers had developed different architectural systems for this. In this paper a survey of frameworks designed to develop a human activity recognition technique is done. This paper makes survey of different types of frameworks such as CenceMe, EmotionSence, Cyberguide etc. And the general terms related to the human activity recognition are explained.***

***Keywords: Context-Aware, ubiquitous, Adaptive, Context Recognition, Human Activity Recgonition.***

## I. INTRODUCTION

Nowadays Smart phones become the heart of the human world. In past few decades usability of the smart phones increased enormously. Due to increased capability of smart phones they can contribute to the human activity recognition study; which includes important key terms such as ubiquitous computing ,Adaptive interface . When talking about human activity recognition it can be done using two aspects online and offline [1].

Context Aware Computing expands itself in such a way that human activity recognition is nothing but to understand the user's activity from their connected sensors.

In this era Mobile phones are that much capable to recognize user activities using sensors. Human activities can be recognized by various ways such as vision based, sensor based and Combination of these two. While vision based limits its usability by using external camera's to recognize the human activities as this leads to two major pitfalls first no one would like to be always get monitored, as everyone wants a private space second video devices are found more difficult to get results on practical basis as it fail to capture each body part when general living activities are performed and finally all this make it complicated, as compared to that of sensor based. This can be also categorized in external and wearable sensors. Wearable sensors are generally used in offline recognition. Many wearable sensors use Machine Learning Toolkit Weka [2],[3]. Modern smart phones are having embedded sensors like microphone, image sensor, inertial sensor, accelerometers, and gyroscope. Accelerometers and gyroscope proved themselves good in terms of understanding human mobility activities and also successful results are gained [4].

Now in above discussion we are talking about human activities, it is quite obvious to having query that what type of activities is recognized? By using these aspects. Day to day activities such as walking, sitting, standing, running, and motor-cycling other than this may be recognized.

 

Because of the direct sensor readings used in HAR, this system is efficient for medical health care, military purposes, etc.

## II. Study of Different Frameworks

Nowadays Human Activity Recognition is a Big point of discussion. As they proved themselves as the centre of attraction of the Smartphone users. Many researcher's had worked on it by considering different data sets and different sensors, like wearable, inertial sensors.

Human activity recognition is nothing but to understand the human activities with the help of the connected sensors. Human activity recognition aims to work with the sensors which are of two types viz. wearable or smart phone sensors.

Wearable sensors deals with the raw data of target signals like heart rate , skin temperature etc. while smart phones use the sensors such as gyroscope ,accelerometer ,microphone.

Further activity recognition is classified as vision based and sensor based or fusion of two , in vision based systems the activity recognition is done using external cameras, and in sensor based human recognition system the Activity recognition is done using sensors.

Human activity recognition system is now used in the medical area to detect early symptoms.

Wearable human activity recognition is done by using sensors such as electrocardiograph and accelerometer For that the first data is collected using the respective sensors then fuzzy decision tree is used to estimate the fuzzy logic of IF-THEN-ELSE loop is applied to get the valid result [5],[6].

Like as wearable sensors human activity recognition can also be done by using the sensors. Supported by the smart phones to recognize human activities or by connecting sensors to human body parts and collecting data from it.

In addition to recognize simple activities complex activities can also be recognized. Comparing to the accuracy of simple activity recognition, complex activity recognition is good.

Dernbatch [7] took readings on 10 individuals with the help of smart phone foe simple as well as complex activities.

They consider simple activities such as biking ,climbing, stairs ,driving ,lying, running, sitting, standing ,and walking and complex activities such as cleaning ,cooking ,Medication, sweeping ,watering plants after that the feature extraction carried out and using WEKA classifiers are applied to the collected raw data from that the results are drawn.

Simple activities are recognized with high accuracy of about 93% and complex activities are recognized with about 50% accuracy [2]. Smart phones support the accelerometer sensor which is used to record to motion of the body ,as accelerometer gives the data of estimated acceleration of body along x, y and z axes by which velocity and displacement are also measured. Akram Bayat * et.al. took readings on 29 users for these following activities.

Slow walking, Fast walking , Running, Stairs-up, stairs-down, n dancing. Then all the phases of human activity recognition are done like data collection, feature Evaluation, Feature extraction, Classification.

They applied classifiers into two sections individual and in combination. Classifiers available in weka toolkit ,multilayer Perception, Random Forest and logic boost, LMT SVM ,Simple logistic and logic boost.

Mashita et. al. introduces two content search systems to recognize the human recognition activities .In order to ease the content searching of use by considering their activities and situations.

1. Location based content search system---runs when user is standing
2. Menu based content system ----runs when user is walking [8].

 

To develop the human activity recognition system soft computing techniques are used viz: fuzzy logic and neural network. Convolution neural networks are used to developed a method for obtaining two features of signal, local dependencies and scale invariance.

*A. Local dependency:*

CNN is used to capture local dependencies of a signal. for example in image recognition tasks pixels of images are mostly correlated with each other.

*B. Scale invariance*

CNN is used to preserve feature scale in variant. For example in image recognition training images may images may have different scale variances.

Publicly available datasets are used for this purpose and then the features are extracted using the CNN networks.

There are many research areas in this topic because it is related to the human activity, there full scope in the direction to increase the usability of the Smart phone's. Researchers can make various research according to the need of user, as this system is now occupying it's position in the human healthcare and military department [9]. In this paper the different frameworks those are required for establishing the human activity recognition system is studied. Many researchers proposed different types of frameworks, such as CenceMe, EmotionSense, Cyberguide etc.

## III. WHAT DOES MEAN BY CONTEXT

Context is something that is used for interaction between users and computing systems According to Webster's new twentieth century dictionary [10] "*Context is the whole Situation background and environment relevant to same happening personality*"

According to oxford dictionary of English "the circumstances that form the setting for an event, statement, or idea, and in terms of which it can be fully understood ."

From the studied literature there are two types of definitions: verbal and non verbal [11]. verbal definitions are exploring, and can be specifying and intentional. Operational definition is the most important non verbal definition. Operational definition explains the term by procedure instead by its own description. The studied literature mostly considers the verbal definitions [10]. introduce two categories of verbal definitions : definition by synonyms and by example.

In definitions by synonyms the context is refer to as the situation or environment. It do not provide any guidance about how to treat the context that's why ,some treat the context as user's situation and some as application's environment. For instance Brown [9] state the context as the elements of the user's environment which is well known by the computer. Whereas Franklin et al. [1] consider it as the user's situation. Ward, Jones and Hoppers(1997)[12] consider it as application surroundings. And Hull, Neaves, Bedford-Roberts [13]view it as aspects of current situation. On the other hand rodden, cheverst, Davies and Dix treat it as application's setting. According to Ryan the context

While doing the study of context definition verbal definition is having problem that all elements of the specified set need to be completely described. And hence this doesn't seems to be an effective approach.

From the study of literature it is found that there are some non verbal definitions available. Schilit.[14]; Dey [15], Pascoe[17] defines the context by providing rules. Schilit gives the instances of context: where the user is, with whom the user is, and what resources are available nearby user. Depending on this a threefold environment is described which includes:

1. The computing environment.
2. The user environment.

 

3. The physical environment.

In this study mostly operational definition states by Dey is considered.

## IV. Context Awareness

In 1992 Active Badge, Want et al. [13] was the pioneers to do research on the context –aware computing. Afterwards many more attempts of research are done in this area.

Hull et al. [17] and Pascoe et al.[12] define Context-aware computing as skill of computing devices to detect and sense, interpret with response according to the users local environment. Plus computing devices themselves.

## V. Context Awareness System

In the given figure Context-aware systems architectural representation is given which is divided into three categories viz.- Stand-alone, Distributed and Centralized architecture. Stand alone architecture is the basic and easy architecture but the main drawback of this architecture is that it can't process device collaboration. and hence it is appropriate for simple and small applications.

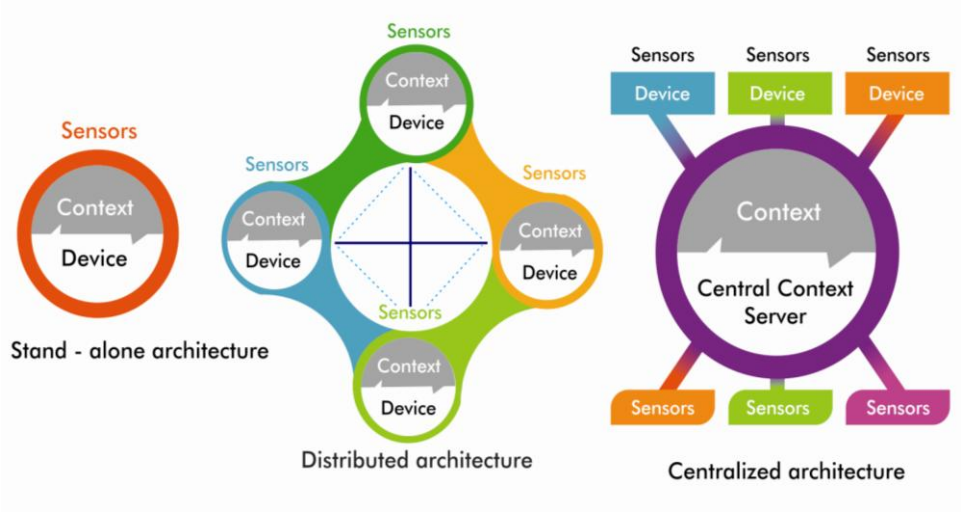


Fig. 1 Architecture Style

Distributed architecture gives the benefit of storing the context information in many separated devices, to the distributed architecture Context-aware systems.

As each device is independent while sharing the context information some less important devices may be ignored which causes less congestion and the context-aware operations are still continued. Ad-hoc communication protocols are required for the secured communication of the devices which are responsible for the context information sharing. but it is very difficult for each device to know the situation of each other device each time and therefore distributed architecture is not suitable for applications having more computations

Centralized context server is connected to the sensors through devices in centralized architecture. Unlike distributed architecture here is the centralized context server to manage each device and keeps the record of situation of each device, because the centralized context server is full of computational powers plus resources. The information requirement of each device is fulfilled by the centralized server.

 

## VI. GENERATION OF CONTEXT AWARE SYSTEM

### A. 1st Generation

By considering the users current location Context-aware system researchers have developed location-based service systems like The Active Badge System[13],[17], cyber guide[18], Sumi et al. [20] in the early 90's. This period is mainly contributed to the focus on researchers on how to achieve users location.

### B. 2nd Generation

Second generation context-aware systems focuses on achieving more generality and supporting for various types of context information. Context Toolkit, Hydrogen, Gaia Project, CASS are the few examples of the 2nd generation.

### C. 3rd Generation

In 2003 OWL is introduced by W3C, which becomes widely used language in the context-aware systems in 3rd Generation. OWL is the web ontology language described as semantic markup language developed for Semantic Web. As OWL is flexible, expressive and knowledge based language it is suitable for context model

#### 1) The Active Badge Location System

In early 90's system at Olivetti Research ltd. Active Badge System was developed that is based on location-aware system. The main aim to built Active Badge system is to manage and forward the users phone-calls according to the person's location. With respect to the person's Location the calls are forwarded to the user's nearest phone. His system is based on the distributed architecture. It uses the Badges (designed tags) which are emitting infrared signals at a decided frequency. The signals are gathered by the sensor networks installed in the building and then these signals are polled by the master station. And it makes context data available for the clients. From this information the call is forwarded to the place closest to the called person [17].

#### 2) Cyberguide

Ward, Andy, Alan Jones, Hopper introduced a context aware electronic tourist guide which depends upon the user's current location. Cyberguide actually help the tourist to visit the nearby historical places which comes under his journey path. It also provides the information those places. For this Cyberguide uses both GPS and sensors [21].

Cyberguide architecture consists of following:

- Electronic geographic card: representing the special remarkable spots in the tourist's current path.
- Browser: is used to provide the information of the related places those are to be visited.
- A Messenger: is used to communicate with the user.

#### 3) CenceMe

CenceMe middleware conclude the presence of individual by using large number of sensors on the mobile phones and it shares information on the social network applications. A split level application approach was developed to share social context. One benefit of sharing context on social network is that social awareness is generated, as the detected social context is transferred to backend server so that it can match the common shared social context [22].

 

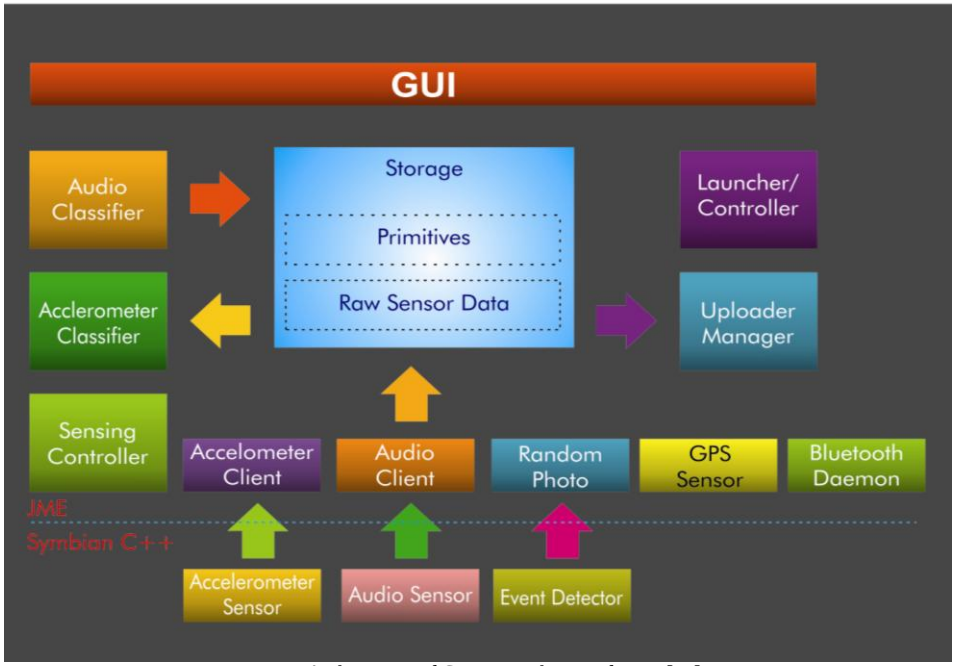


Fig. 2 Architecture of CenceMe Phone software [22]

*4) Emotion Sense*

Rachuri et al. introduces Emotionsence in 2010.As its name suggests its main focus is on the psychology context. It behaves according to the user's emotions. Following is the information flow of Emotion Sense Architecture [23].

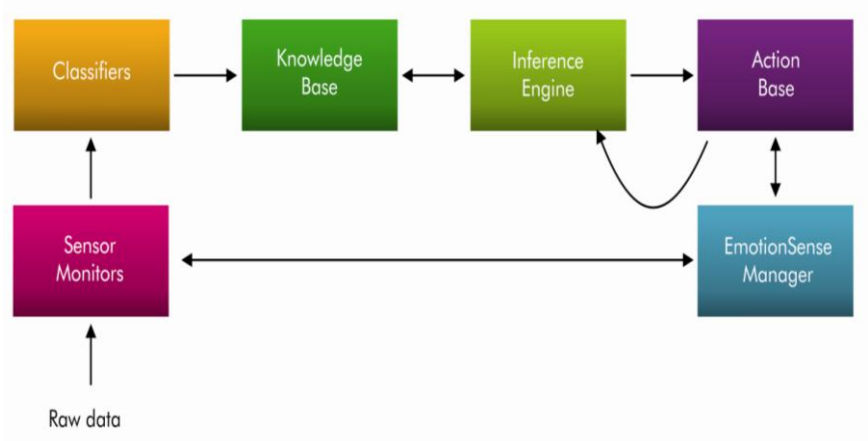


Fig. 3 Information Flow in Emotion Sense

The EmotionSence with the help of the Bluetooth, GPS, and microphone, emotions, locations and speaker's identities are detected by middleware. Walse et al. [24] discussed frameworks for adaptive mobile interface in detailed.

## VII. Applications of Human Activity Recognition

Human activity recognition has many application in many different areas. Following table shows applications in different type of areas, those are divided into three main categories End user Application, in which sub points like Fitness tracking, Health monitoring ,Fall Detection, Context-aware behaviour, home/work automation comes etc.

Next Category is third party applications such as targeted advertising, research platform etc. Next category is Crowd and social network applications.

Usability of Context Awareness and Recognition get increased of it is used in such general areas. Lockhart et al. [8] carried out brief discussion on this point.

TABLE 1 SUMMARY OF HUMAN ACTIVITY RECOGNITION APPLICATIONS (WITH EXAMPLE APPLICATIONS)[8]

| **End User Applications** | |
|---|---|
| Fitness tracking | Actitracker provides online activity history |
| Health monitoring | Evaluate patients over time |
| Fall detection | Detect falls and proceed action |
| Context-aware behavior | Disable calls while jogging |
| Home/work automation | Smart homes that anticipate user's needs |
| Self-managing systems | Save battery by turning off WiFi while jogging |
| Third Party Applications | |
| Targeted advertising | Provide users with relevant ads |
| Research platform | Provide platform for collecting activity data |
| Corporate management & accounting | Track employee time and ensure spent appropriately |
| Crowd and Social Network (SN) Applications | |
| Traditional SNs | Share activity information with friends and followers |
| Activity-based SNs | Connect people based on their activity profiles |
| Place & event detection | Identify popular areas for exercise and recreation |

## VIII. PROPOSED METHODOLOGY

Human activity recognition becomes the interesting part in the technical industry. Many new concepts have arrived related to this topic. Many online applications are available for detecting human activity recognition. Instead of using online system using offline systems the main aim behind designing this system is to make the mobile phone that much capable so that the features can be enhanced and an offline efficient human activity recognition system can be developed.

Many researchers experimented on collected data and many on standard dataset. We are designing framework which is tested on the WISDM [25] dataset. Framework can also be improved by connecting it to clouds and expanding its usability for many sensors. Framework can be defined in many ways we have designed it in the form of layered architecture.

## IX. OVERVIEW OF PROPOSED HYBRID APPROACH

Human Activities Recognition System is formed from many functional blocks. Each block performs a different task for each training process and identifying action. The human activities recognition system can consists of four main functional modules. These include-

- Data acquisition and data processing module
- Feature extraction module
- Training module
- Human activities recognition module on smartphone

An overview of Hybrid Approach is taken here to understand its relevance for the present research. It is an assimilation of different allied approaches which include Standalone, Client-Server and Cloud. Thus, the present assimilation could be referred as 'hybrid'. It brings combined approach fetching the best output of the three approaches.

### *A. Standalone Framework*

In this standalone framework, all activity recognition steps are done locally on the mobile phone in real time *i.e.* online or can be done offline. These steps include data collection, pre-processing and classification. In this approach, the results and the raw data can also be sent to a server additionally for further analysis. However, the main three steps are performed locally. The training can still be done on a desktop machine beforehand or on the smartphone locally.

 

*B. Client-Server Framework*

In Client-Server approach, the sensing for data acquisition is done on the smartphone, which acts like a client. Then, the collected data are sent to a server or a cloud for further real-time processing, such as pre-processing and classification. The pre-processing step can partially reside on the smartphone, too. However, the main classification step is performed on a server. This approach is adapted in order to run the computationally-expensive steps on a server, because of the limited resources of smartphone.

The Fig. 4 shows the hybrid approach of proposed framework which uses layered approach in framework. This layers has bottom-up approach *i.e.* Sensing layer, Pre-processing layer, Classification layer, Application layer.

*C. Proposed Hybrid Framework*

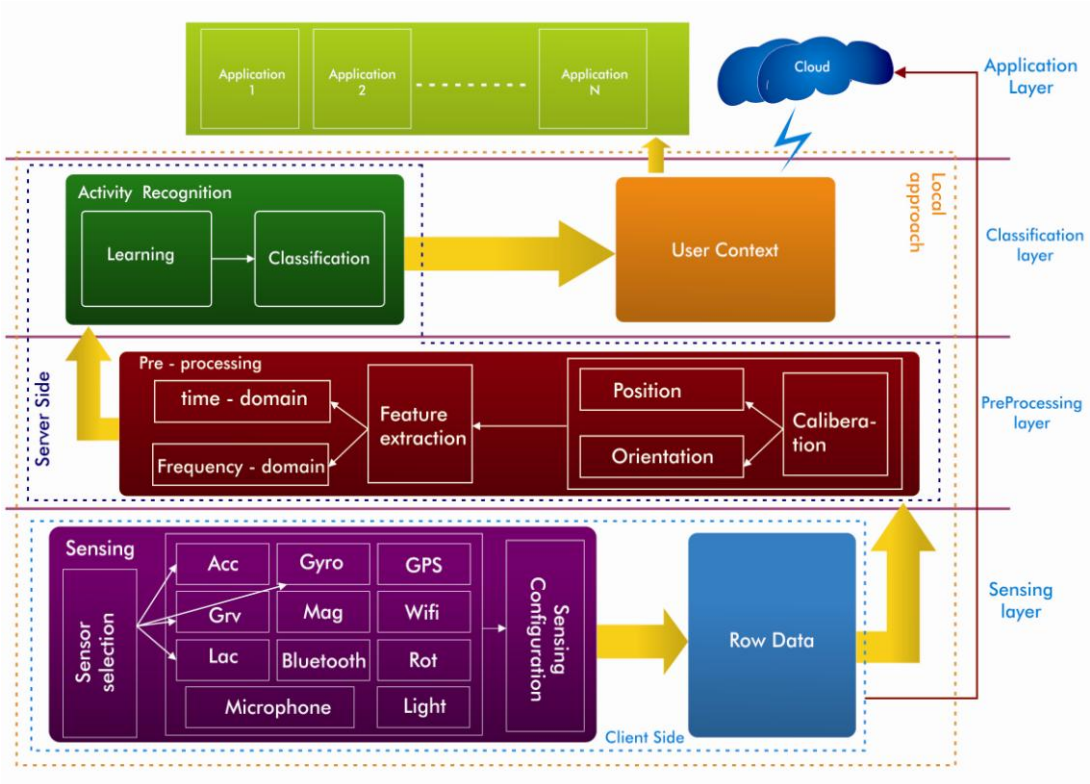


Fig. 4 Proposed Framework for HAR

*1) Sensing Layer*

In sensing layer, sensor selection is used to select appropriate sensor for activity recognition. This layer consists of built-in sensors from smartphone such as accelerometer, gyroscope, gravity sensor, magnetometer, linear acceleration, Bluetooth, GPS, rotation sensor, WiFi, Microphone, Light sensor, temperature *etc.* After selecting appropriate sensor, that sensor is configured. At this layer, raw data obtained from sensor are selected while performing activities by various subjects. The obtained raw data is then forwarded to pre-processing layer.

*2) Pre-processing and Feature Extraction Layer*

At this layer, pre-processing such as noise removal, handling missing values is done on raw data. Then this processed data is forwarded for feature extraction where the features are extracted in time and frequency domain, which forms feature vector. This featured vector is then forwarded to classification layer further for activity recognition.

*3) Classification Layer*

In classification layer, the feature vector is distributed for training, testing and cross validation for activity recognition. These pre-processing layer, feature extraction and classification layer are implemented in smartphone for light-weight standalone model. The training data is forwarded to server for further processing. In client-server model, the pre-processing

layer and feature extraction layer are implemented on server. Classifier training is implemented on server while testing and cross validation are implemented on client. These can easefully balance load. But Client-Server and cloud approach require an Internet connection at all times for sending sensor data for further processing over a server or over a cloud. After training of classifiers, the required trained data, it is transferred back to smartphone client for recognizing context and adapt user. This classified data can be used by applications developed at the application layer.

*4) Application Layer*

At the application layer, various applications can be developed, which would be at users' disposal to use. These applications use the context data to recognize the activity and adapt the mobile user interface according the situation or environment. These applications can provide a feedback to the user regarding the recognized activity. The application can be used in the area of user interface adaptation, health care, senior citizen care, etc.

## X. Conclusion and Future Work

In this paper, we reviewed the different types of frameworks and studied their architecture style, their strengths and weakness. In this work, we have proposed hybrid framework which designed in layers. So it can provide flexibility. Behind using the sensors the main aim is to recognize the exact activity of user.

## References

1. Bayat, Akram, Marc Pomplun, and Duc A. Tran. "A study on human activity recognition using accelerometer data from smartphones." Procedia Computer Science 34 (2014): 450-457.
2. Yang, Jun. "Toward physical activity diary: motion recognition using simple acceleration features with mobile phones." In Proceedings of the 1st international workshop on Interactive multimedia for consumer electronics, pp. 1-10. ACM, 2009.
3. Santofimia, Maria J., Xavier Del Toro, Jesus Barba, Felix J. Villanueva, and Juan Carlos López. "Leveraging Common-Sense in Human Activity Recognition." In 2011 International Conference on P2P, Parallel, Grid, Cloud and Internet Computing, pp. 225-230. IEEE, 2011.
4. Zhu, Yangda, Changhai Wang, Jianzhong Zhang, and Jingdong Xu. "Human activity recognition based on similarity." In Computational Science and Engineering (CSE), 2014 IEEE 17th International Conference on, pp. 1382-1387. IEEE, 2014.
5. Khalifa, Sara, Mahbub Hassan, Aruna Seneviratne, and Sajal K. Das. "Energy-Harvesting Wearables for Activity-Aware Services." Internet Computing, IEEE 19, no. 5 (2015): 8-16.
6. Bieber, Gerald, Thomas Kirste, and Michael Gaede. "Low sampling rate for physical activity recognition." In Proceedings of the 7th International Conference on PErvasive Technologies Related to Assistive Environments, p. 15. ACM, 2014.
7. Dernbach, Stefan, Barnan Das, Narayanan C. Krishnan, Brian L. Thomas, and Diane J. Cook. "Simple and complex activity recognition through smart phones." In Intelligent Environments (IE), 2012 8th International Conference on, pp. 214-221. IEEE, 2012.
8. Lockhart, Jeffrey W., Tony Pulickal, and Gary M. Weiss. "Applications of mobile activity recognition." In Proceedings of the 2012 ACM Conference on Ubiquitous Computing, pp. 1054-1058. ACM, 2012.
9. Brown, Peter J., John D. Bovey, and Xian Chen. "Context-aware applications: from the laboratory to the marketplace." Personal Communications, IEEE 4, no. 5 (1997): 58-64.
10. Dey, Anind K., Gregory D. Abowd, and Daniel Salber. "A conceptual framework and a toolkit for supporting the rapid prototyping of context-aware applications." Human-computer interaction 16, no. 2 (2001): 97-166.
11. Mashita, Tomohiro, Daijiro Komaki, Mayu Iwata, Kentaro Shimatani, Hiroki Miyamoto, Takahiro Hara, Kiyoshi Kiyokawa, Haruo Takemura, and Shojiro Nishio. "A content search system for mobile devices based on user context recognition." In Virtual Reality Short Papers and Posters (VRW), 2012 IEEE, pp. 1-4. IEEE, 2012.
12. Rodden, Tom, Keith Cheverst, K. Davies, and Alan Dix. "Exploiting context in HCI design for mobile systems." In Workshop on human computer interaction with mobile devices, pp. 21-22. 1998
13. Want, Roy, Andy Hopper, Veronica Falcao, and Jonathan Gibbons. "The active badge location system." ACM Transactions on Information Systems (TOIS) 10, no. 1 (1992): 91-102.
14. Schilit, Bill, Norman Adams, and Roy Want. "Context-aware computing applications." In Mobile Computing Systems and Applications, 1994. WMCSA 1994. First Workshop on, pp. 85-90. IEEE, 1994.
15. Brown, Peter J. "The stick-e document: a framework for creating context-aware applications." ELECTRONIC PUBLISHING-CHICHESTER- 8 (1995): 259-272.
16. Ryan, Nick, Jason Pascoe, and David Morse. "Enhanced reality fieldwork: the context aware archaeological assistant." Bar International Series 750 (1999): 269-274.Computer applications and quantitative methods in archaeology 1990. Tempus reparatum, 1991.

 

17. Korpipää, Panu. Blackboard-based software framework and tool for mobile device context awareness. VTT, 2005.
18. Paymans, T. F., J. Lindenberg, and M. A. Neerincx. "Usability issues of adaptive user interfaces." (2003).
19. Dey, Anind K. "Context-aware computing: The CyberDesk project." In Proceedings of the AAAI 1998 Spring Symposium on Intelligent Environments, pp. 51-54. 1998.
20. Webster, N. "Webster's new twentieth century dictionary of the English language. Springfield, MA: Merriam-Webster." (1980).
21. Ward, Andy, Alan Jones, and Andy Hopper. "A new location technique for the active office." Personal Communications, IEEE 4, no. 5 (1997): 42-47.
22. Miluzzo, Emiliano, Nicholas D. Lane, Kristóf Fodor, Ronald Peterson, Hong Lu, Mirco Musolesi, Shane B. Eisenman, Xiao Zheng, and Andrew T. Campbell. "Sensing meets mobile social networks: the design, implementation and evaluation of the cenceme application." In Proceedings of the 6th ACM conference on Embedded network sensor systems, pp. 337-350. ACM, 2008.
23. Rachuri, Kiran K., Mirco Musolesi, Cecilia Mascolo, Peter J. Rentfrow, Chris Longworth, and Andrius Aucinas. "EmotionSense: a mobile phones based adaptive platform for experimental social psychology research." In Proceedings of the 12th ACM international conference on Ubiquitous computing, pp. -290. ACM, 2010.
24. Walse, Kishor H., Rajiv V. Dharaskar, and V. M. Thakare. "Frame work for adaptive mobile interface: an overview." In IJCA Proceedings on National Conference on Innovative Paradigms in Engineering and Technology (NCIPET 2012) vol, vol. 14, pp. 27-30. 2012.
25. Walse, Kishor H., Rajiv V. Dharaskar, and Vilas M. Thakare. "A study of human activity recognition using AdaBoost classifiers on WISDM dataset." The Institute of Integrative Omics and Applied Biotechnology Journal 7, no. 2 (2016): 68-76.

 

## AUTHOR(S) PROFILE

**K. H. Walse,** is working as Assistant Professor at Anuradha Engineering College, Chikhli Distt. Buldana. Prior to this He was Principal at Shreeyash Polytechnic, Aurangabad during 2010-12. He was with Anuradha Engineering College as an Assistant Professor of Computer Science and Engineering where he leads the HCI Research Group(1996-2010) Prior to joining Anuradha Engineering College in 1996, he was an Lecturer of Computer Science and Engineering at SSGMCE, Shegaon (1994-1996).

He received his Masters in Computer Science and Engineering from S.G.B. Amravati University, India. Prior to joining academia he spent 03 years working in industry in development of computer networks. He had been a technical program Convener for ACM ICAC-2008 International Confernce.He is Fellow Member of IEI and IETE, India, Senior Life Member of Computer Society of India, Professional Member of ACM and IEEE Professional Society. He is working as Editor-in-Chief for the reputed International Journal of Computer Science and Applications (IJCSA),He has published many research papers in International Journal and International Conferences. Currently he is perusing his Ph.D. research work in S.G.B. Amravati University, India.


**Ms. Vrushali G. Joshi,** studying Master in Engineering at Anuradha Engineering College, Chikhli Distt. Buldana. She has completed her graduation from same institute.

**Dr. Rajiv V. Dharaskar,** is Director at MPGI Group of Institutes Integrated Campus, Nanded. Prior this he worked as former Director, Disha Education Society (DES, DIMAT. Disha Technical Campus) Raipur. In 2014, the State Government of Chhattisgarh has given LOI for establishing State Private University to DES. He is former Professor and Head, PG Department of Computer Science and Engineering, G H Raisoni College of Engineering, a TEQIP II benefited Autonomous Institute, Nagpur. Professor is Ph.D. in Computer Science & Engineering in the Faculty of Engineering & Technology, M.Tech. (Computers), P.G. Dip. (Computers), M.Phil., and M.Sc. He is having 31 years of teaching and 25 years of R&D experience in the field of Computers & IT.

Professor has authored number of books on Programming Languages. He has published series of 6 books on World Class Universities and Innovation and reached to 20 Lakhs readers across the 100 nations, which has been appreciated by UGC and AICTE Chairman, IIT / NIT Directors and hundreds of Vice Chancellors and high profile authorizes of Academic and Industry in India and Abroad.

He has published over 300 research papers on computer engineering. He has guided 9 Ph.D. scholars and is guiding more than 10 PhD research scholars on various subjects like Digital Forensics / Cyber Security, Software / Usability Engineering, HCI, Mobile Computing, E-Commerce, E-Learning etc. He has delivered numerous Keynote addresses at international conferences and serves on several International advisory boards. He is on editorial or review board of prestigious International Journals and worked as a Reviewer for dozens of International Conferences.

He was involved in administrative activities of different Universities and Autonomous institution like Member of Academic Council, Board of Studies, Affiliation and Selection committees and Chairman PG Moderation committees etc. His details are available at www.dharaskar.com

 