A Study on Efficient Monitoring of Elderly People by Automatic Activity Recognition Using Variable Sensors

Syeda Noor Fathima[1] . Syeda Ayesha Siddiqha[2]

[1,2] School of Engineering
Presidency University, Bengaluru, India.

Received: 08 July 2022 / Revised: 28 July 2022 / Accepted: 05 Aug 2022

Abstract – In modern era of hyperactive working environment culture, a challenge is seen in monitoring the elderly people at the home. This paper focus on how elderly parents can be monitored under a sensor configuration. The main objective of this survey paper is to focus on the agenda of how exactly WSN and inter-networking environment is used with a sophisticated technological usage. The paper also includes various proposed terminologies and the proposed methodological protocol on this subject.

Keywords – WSN, Internetworking, Remote patient monitoring, variable sensor unit

I. INTRODUCTION

To start with, we can shift our focus towards the basic needs on why exactly we need this system in current situation? To answer this, we can use the available survey from [1]. According to this survey [1] around 1 Billion people are above the range of 65 years as per 2015 and this is expected to rise significantly in coming years. And thus this has become thrown a challenge on how exactly an elderly person is monitored in absence of the care takers. Various sensors has been proposed and designed to achieve this task and hence forth we shall discuss the same with a detailed comparison in this paper. The major sensors in the market include gastropedic, Heart-rate sensors, Blood pressure sensors and many more basic sensors such as Temperature, pressure and strength.

II. LITERATURE REVIEWS

As the main objective of this paper is to compare the work done in the segment of remote patient monitoring, and [2] –[8] are the overall survey papers considered for the survey.

1. General Purpose Sensors

To achieve initial paramedical parameter we have observed many general purpose sensors such as temperature and pressure. The

temperature sensor is incubated with all the real-time activities such as bathing, performing exercise and many more. The change of temperature of human body is directly dependent to the amount of calories burring rate. The accuracy of these general purpose sensors varies from one scenario to another and thus it is challenging to depend upto these sensors for data accuracy. [3][4]

2. Review of Dedicated Sensors

General purpose sensors are used to estimate an overall status of the body and whereas the dedicated sensors such as gyroscope, Heart-rate Monitoring Sensors and Blood Pressure Sensor etc. are used to focus on a given targeted area. According to a survey conducted by Dept. of Health and Planning, USA a reported increase has been seen towards CVD (Cardio Vascular Diseases) and Cancers (Breast, Liver and Pelvic).

With the use of dedicated sensors a targeted organ can be continuously monitored to maintain a precautionary environment.[6]

3. Multi-Sensor Environment

In order to achieve a higher performance in the devices of remote monitoring, a hybridization s been proposed with integration of multi sensors e.g., Monitoring heartbeats through heart rate sensors is effective in an solo initialization, whereas according to the resource (Medical) the parameter of heart abnormality can be depicted from an increased heart sounds and thus the temperature of an individual is effected from normal. Thus according to the survey of this paper, we propose an hybrid environment of sensor integration for a patient monitoring under a single device is an efficient way.

Apparently, we shall also focus on the platform and the integrating environment for these multi sensors to perform efficiently. According to Saisakul and et. al sensors with high integration are performed as follows.

Sensor	*Platform*	*Rate*
Temperature	Independent	89.6F - 212F
Accelerometer	MSP 430 +	±2G (m/s^2)
Pressure	MSP 430 +	30 – 120 kPA
Gyroscope	32 bit MP	168–179 MHz
Heart Sensor	32 bit MP	Normal
BP	MSP 430 +	120 U / 80 L

From the above table we have summarized the performance and efficiency of the system with respect to the rate at which it can perform. Thus the overall performance ratio is dependent of sensor integration.

III. MACHINE LEARNING APPROACH

This approach is a new trend in the field of remote patient monitoring and sensor based result analysis. The system equipped with programmed sensors has to collect the reading in a given interval of time with respect to the scenario and conditions. Under this technique a programming environment is been enhanced with an equivalent tools for modernization. This also includes pattern recognition and feature extraction process.

From our paper, we shall conclude on why machine learning techniques should be incorporated in the monitoring system? As the demand of monitoring and easy in recovery has increased, improvements in the system performance shall be improved with more trust-ability factor. Including machine learning intern includes pattern recognition and thus the complexities of system are increased.

Feature Extraction: As machine learning is included, FE comes as an add-on for this process. The process of feature extraction in sensor depends on peak threshold value variations. These values are

stainable and are observed under medical conditions and research scenarios. Considering an example to justify the feature extraction of a sensor, let's consider an ECG data acquisition from heart-rate sensors, the peak nod values are threshold for observation and thus the system is constantly monitored to achieve a static parameters.

Case 1: ***Variations in Sensor***

Considering the above scenario, a threshold nod value is been assigned for acquired peaks. On reaching the observed threshold values, A programming modules are improvised to fetch a pattern under this abnormalities scenario. The fetched data or signal values are computed and a pattern is extracted for analysis. On successful extraction, meaningful results have been concluded and a review is set back for acknowledgement.

Case 2: ***Pattern Matching and Analysis***

On successfully fetching regular patterns and recording positive feed backs improvises the system. This improvisation is considered for self-decision making and instant analysis for the condition encountered.

Analyzing the patient behavior based on his/her previous records makes the system intelligent and provides an accurate rate of result with an enhanced performance.

In general, adopting a machine learning techniques shall increase complexities of the system and also the overhead load. On survey, a conclusion could be made as to include these features at the cost of compromising with performance speed and accessibility rate.

IV. DISCUSSION

From the detailed survey, a clear picture of sensor based remote patient monitoring is studied with various sensor environments, its integration and also a case study under machine learning techniques. We have also included various threshold parameters for the medical sensors. These sensor thresholding values and its breaking peaks has been survey and discussed.

From the survey, we have seen an improvement in data acquisition and processing apart from communication and true values sharing.

In general, we have studied various sensors and also those working conditions and thus conclude to make a system configuration under a hardware (LIVE) sensor simulation for data collection and monitoring. This proposed project shall abide a multisensory environment including, Heart-Rate sensor, BP Sensor and general purpose sensor for hybrid signal collection and monitoring.

The proposed system shall work on a 32 bit microcontroller under MSPX32 architecture for processing under a buffer size of 128 Bit. The device shall monitor multi sensor information under a given scenario and observing conditions. The major objective of implementing this sensor circuited is intended to showcase a networking and computing environment under an electronic background.

V. CONCLUSION

In this study, a comparison between sensors, its threshold values and working scenarios is been made. We have also performed this survey to move ahead with a sensor circuitry design under a hardware and real-time calculation of data for accuracy establishment and overall system dependency improvement.

REFERENCES

1. English, W. H. World population. *World*, *103*(127), 148.
2. Chernbumroong, S., Cang, S., Atkins, A., & Yu, H. (2013). Elderly activities recognition and classification

for applications in assisted living. *Expert Systems with Applications*, *40*(5), 1662-1674.

3. Nam, Y., & Park, J. W. (2013). Child activity recognition based on cooperative fusion model of a triaxial accelerometer and a barometric pressure sensor. *IEEE journal of biomedical and health informatics*, *17*(2), 420-426.
4. Maurer, U., Rowe, A., Smailagic, A., & Siewiorek, D. (2006). Location and activity recognition using eWatch: A wearable sensor platform. In *Ambient intelligence in everyday life* (pp. 86-102). Springer, Berlin, Heidelberg.
5. Gjoreski, H., & Gams, M. (2011). Activity/Posture recognition using wearable sensors placed on different body locations. *Proceedings of (738) Signal and Image Processing and Applications, Crete, Greece*, *2224*, 716724.
6. Periasamy, K., Periasamy, S., Velayutham, S., Zhang, Z., Ahmed, S. T., & Jayapalan, A. (2022). A proactive model to predict osteoporosis: An artificial immune system approach. *Expert Systems*, *39*(4), e12708.
7. Parkka, J., Ermes, M., Korpipaa, P., Mantyjarvi, J., Peltola, J., & Korhonen, I. (2006). Activity classification using realistic data from wearable sensors. *IEEE Transactions on information technology in biomedicine*, *10*(1), 119-128.
8. Fleury, A., Vacher, M., & Noury, N. (2009). SVM-based multimodal classification of activities of daily living in health smart homes: sensors, algorithms, and first experimental results. *IEEE transactions on information technology in biomedicine*, *14*(2), 274-283.
9. Ohtaki, Y., Inooka, H., Sagawa, K., Suzuki, A., Xiumin, Z., Okutsu, M., & Nagatomi, R. (2004). Recognition of daily ambulatory movements utilizing accelerometer and barometer. *Power*, *100*, 102.
10. Hong, Y. J., Kim, I. J., Ahn, S. C., & Kim, H. G. (2010). Mobile health monitoring system based on activity recognition using accelerometer. *Simulation Modelling Practice and Theory*, *18*(4), 446-455.
11. Barsocchi, P. (2012). Position recognition to support bedsores prevention. *IEEE journal of biomedical and health informatics*, *17*(1), 53-59.
12. Patil, K. K., & Ahmed, S. T. (2014, October). Digital telemammography services for rural India, software components and design protocol. In *2014 International Conference on Advances in Electronics Computers and Communications* (pp. 1-5). IEEE.

MILESTONE RESEARCH PUBLICATIONS