Context-Aware Elderly People Monitoring based on IoT

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Abstract- In pervasive computing, the area of context-awareness is considered as an important technology and also plays an important role in the area of healthcare environments. In this paper proposes a system for elderly people signs monitoring and critical health conditions which is sends to the caregivers to identify the daily activities by using internet of things (IoT) this can be done in real-time. For example the elderly people who are not well in daily activities like current health status is “normal” or “critical” and the caregivers can give the early suggestions to the people who are in nearby. The author build a fuzzy logic from the beginning of data acquisition, processing of the data namely filtering, aggregating it into contextual information and reasoning to identify the elderly people health condition. Variety of connected devices can modify the remote characteristic, real-time monitoring, measuring and transmitting numerous body health parameters for making the decision and medication. The goal of this paper is to introduce the approach Context Aware Smart Home Caregivers System (CASHCS) to recognize the usual and unusual conditions of the people health status so that doctor can cure the problems in early stage without any complication. So this can be developed to construct a context-aware healthcare application framework.

Keywords – Context-aware, Fuzzy Inference System, Internet of things, CASHCS.

I. INTRODUCTION

The term Internet of Things was used by Kevin Ashton [1] in 1998. The IoT allows things and people to be linked Anytime, Anyplace, Anything and Anyone using any network and service with best way possible [16]. Context aware systems have more enthusiastic much concentration from researchers in recent years. Numerous context-aware systems have been developed to illustrate usefulness of this technology. In many applications, the internet of things and context aware systems plays an important role in healthcare. It was possible to capture different information on the elderly and the physical, psychological and mental state of the patient. Automation of data collection decreases human error risk. In this healthcare section, the caregivers can get the authentic information about the elder people monitoring and error rate of the negligible so this will improve the quality of the elder people monitoring and avoid the negative information [2, 3]. In order to prevent unnecessary costs with doctors, elder peoples can maintain a home monitoring system which permits people to maintain interaction with doctors and personal healthcare. In this article, current CASHCS’s comprehensive healthcare architecture is focused on web-based monitoring system.

The CASHCS systems main components are

**Elder people home monitoring system:** This is intended to help elderly people live independently at home. The system includes a web camera that can be used to monitor and intercommunicate between the elderly and the caregiver.

**Clinical Monitoring System:** This is reliable for the remote control of the BAN and the constantly monitoring of the elderly’s physiological signals through the internet. In addition data acquired from BAN in real time are recorded on the server for further examination and analysis. In this article, suggest a system that provides various uses for tracking healthcare at home. It enables the elderly individual carry out the operations in their own life and at the same time makes it easier for family members and care providers to track inhabitants.
According to figure 1, the systems have a common architecture and a set of properties. This consists of two levels like services and applications which is used to collect and analyze the sensory data from the elder people. The general healthcare architecture is represented.

![Healthcare Architecture Diagram](image)

Figure 1. Healthcare Architecture

The system has diverse kind of sensors to monitoring the elderly people and it will empower the fully and securely control the elderly patient care. In this approach each section is processed and analyzed with particular techniques, based on the fuzzy rule techniques a data can be directed. The objective of this job is to take advantage of the above mentioned IoT capacities and create intelligent systems for the customized healthcare of elder people at home with real-time surveillance and interaction. The proposed model not only provides elderly care with the medical care, as well as takes care of their delights and offers opportunities. This is formed as follows in section 2 explains about the related work regarding healthcare systems and history of healthcare. In section 3, explains about system architecture. Healthcare methods like fuzzy, rule based models and Context aware smart home care giver system can be explained in section 4. The research will get finish with conclusion in section 5.
II. RELATED WORKS

In this paper patient can monitor through the sensor in the basis of fuzzy logic technique and handled by the algorithm to make decisions about the elder people living alone in home. If we have to set the alarm level as an output if so sends a collected data to server [4]. In recent years, research in mobile health applications has growing been regarded as a fuzzy logic system for the elderly in the home. The key success of systems is context-aware mobile environments and it will completely support the people with day-to-day medical circumstances. In this article, author utilizes three different sensors to build an individual monitoring system for in-home elderly people who live in their home alone. The sensors are microphones, infrared and physiological sensors. EMUTEM architecture is presented for monitoring and The Fuzzy Logic Decision Module strengthens safe detection of misery occurrences and elderly people's place. This approach makes it easier to combine data with other sensors [5]. In this paper the proposed vital sign monitoring system for mHealth is intended to help clinicians by illustrating the trace of critical physiological parameters, generating early warnings / cautions and signifying any important changes in data. In the monitoring and delivery of healthcare interference, mobile healthcare (mhealth) applications are becoming progressively important and patient monitoring and diagnostic systems based on mHealth virtually anywhere like home, hospital and outdoor [6]. In this paper, author evaluates the number of older people’s who are affected by chronic illnesses, disabilities and functional limitations. Moreover, a large number of elderly people need ordinary support for their daily lives and healthcare, most of which are encouraged by family, friends or caregivers [7]. Healthcare organization can monitor the elderly overall health in real-time and provide observation and support from remote facilities [8]. The focus of the proposed framework is on healthcare applications. Since patients enabled by IoT can be approached through the internet and other equipment, the health situation of a patient can be tracked without disruption, enabling the immediate detection of critical diseases in order to take appropriate action either locally or remote [9].

The CARA e-Healthcare system presented to provides a solution from patients at risk when expert is not present. The system can measure physiological signals constantly and process the data locally at a base station in real-time to a remote location. All the communications are carried out using web technologies. The CARA application is the important technology for remote monitoring system of caregivers [10]. In this paper is a smart city-oriented infrastructure was presented to capture and manage data relating ot the behavior of elderly people and paradigms of the Internet of Things and linked to open data to provide a scalable and flexible system capable of simultaneously providing services to multiple cities [12]. In this paper the author proposed a remote monitoring system based on fog for chronic neurological diseases. Then the system can collects and processes motion data on the edge gateways [13]. This paper presents the activity monitoring system which includes activity recognition model and sensor. By comparing their performance, the authors demonstrate the potential of generative and discriminative models for activity recognition and Hidden Markove Model HMM) also represented [14]. This paper describes ACTiVAGE (ACTiVE Ageing sErvices), a conceptual frame work for the development of personalized services for the elderly who use big data analytics for context wareness in smart environments [15]. In this paper author explained about agent-based architecture, is used to characterize the information by the sensors and a resource allows the agents to interact with them. The agent is used to replace the data between the agent and applications [17]. Hence this paper proposed a system is Smart Home Caregivers System (SHCS) can monitor the patient's real-time respiratory range, oxygen leakage data, normal and abnormal circumstances [18].

III. PROPOSED ARCHITECTURE

The system architecture includes four types of layers and middleware namely data representation, analysis layer, context-awareness layer and service layer which is represented in figure 2. The first layer is data representation it can get the healthcare data from sensors. The second layer is analysis layer here context modeling is mentioned which includes data filtering, aggregating the data to change it as a context data and rule based modeling is used for elder people monitoring, based on the rules the data can be retrieved from the knowledgebase and then from the modeling the data is preprocessed. Context aware reasoning can be used the data from knowledgebase for feature extraction. Context-awareness services that can be dynamically configured using the identity, location, time and understanding of day-to-day user activities to recommend customized user requirements. In this part context and elder people activity is represented that is Daily Activity Living (DAL). The fourth layer is service layer, used to monitor the elder people in real-time and health condition monitoring, to identify the usual and unusual satiations of the people health status. Here middleware appear as a link between smart home caregiver system represented in [18] and context database.
IV. FUZZY INFERENCE SYSTEM

Fuzzy rules use diverse parameter membership categories to track and determine the nature of the events. Therefore, instead of threshold parameters, we use fuzzy rules in our system. The concept of the auxiliary data set for fuzzy logic is showing in Figure 3. Fuzzifications are followed in three phases, they are:

Step 1: A range of the real value obtained from the sensor, forming a collection of a crisp value, i.e. a crisp set value \( x \in X \) (where \( x \) is set of all values read by the sensor). At this time, membership functions are created using knowledge-based experts. It can convert crisp raw data into fuzzy linguistic variables.

Step 2: The inference engine fuzzy is intended so that these fuzzified inputs can be inferred from the earlier stage using the IF premise, consequently, check with the rule base and generate fuzzy output variables. The assumption involves fuzzy input variables linked through logical functions (AND, OR, NOT) and the consequential variable consists of fuzzy output.

Step 3: In the end, these variables of fuzzy output is transformed by defuzzifies into a crisp set of values, to create required actions and events, these crisp values can be used. Defuzzification is carried out using the centroid method in practice.

4.1 Automation sensors in home

We have to solve the significant problem of elder people's privacy by using in-home healthcare monitoring. The associated information of the movement can be gathered twice a second and stored with the moment of the case in the suitable file. Each movement can be noted along with the time and data are shown in the results of the automatic processing. This subsystem is supplemented with a set of wireless ambient sensors intended to monitor the environment and environment of the patient through telemonitoring. It includes state-of-the-art sensors for the detection of active devices, contact sensors for the opening / closing of doors and windows, light sensors, fire sensors, temperature sensors and flood sensors.
V. CONTEXT AWARE SMART HOME CAREGIVERS SYSTEMS (CASHCS)

For older people health care monitoring Smart Home Caregivers System can be used and for vital sign monitoring matlab simulation was used. The input variable includes, body temperature, ECG, blood oxygen, heart rate and respiration rate. Linguistic variables such as low, medium, high and very high symptoms are assigned for membership values. The older people data is stored in a database and information is obtained from the knowledge base by matching the symptoms and their harshness against the original part of the fuzzy rules. By the use defuzzification the fuzzy values can be defuzzified and finally the designed systems appear at a crisp decision for the diagnosis disease.

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Table -1 Elder people Daily activities and body motion

<table>
<thead>
<tr>
<th>Elder People Activities</th>
<th>Elder People Body Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter home, Getting up, Toilet, watching tv, Cleaning, Bathing, Cooking, Planting, Hearing, music</td>
<td>Walking, Standing, Laying, Sitting, Sleeping, And Exercising.</td>
</tr>
</tbody>
</table>
Here we are using three fuzzy set input levels includes low, high, medium. Activity fuzzy sets are four levels like static, disturbance, normal and rest. Membership function of position is represented in two levels like sitting down and lying. Health condition of fuzzy set is two includes well and not well and the sensor device either in turned on or turned off. The member function can be defined and associate with the activity is adjusted for every elderly motorized individual. The inputs are activity, location and health circumstances that can be used in CASHCS. Membership function characterize the sensor as low, medium, high the fuzzy logic outputs can be obtained by some elderly people activities which is selected from table 1. they are Sleeping (S), Toileting (T), getting up (GP), Cleaning(C), Bathing (B), Resting (R), Watching TV (WTV), Standing up (SU), Sitting Down (SD), Washing(W), Talking in Mobile (TM), then the fuzzy inputs are represented in table 2. According to the activities of the above membership function can be occur and secondly degree of similarity can be obtained [11]. The rules and the capability to model the special cases can recognize common achievement of the operations of elderly individuals.

For instance of fuzzy alarm detection rule is

Rule 1: If (Elder person is Ring tone) and (Activity is Motion) and (sensor is high) and (getting up is high) and (walking is Normal) and (sensor device is turned on) Then (Elder person is attending the call)

Rule 2: If (Elder person is Sound) and (Activity is Motion) and (sensor is high) and (laying is high) and (Standing is high) and (sensor system is turned on) Then (Elder Person is in Cough).
Patient details can be monitored through the base station by the smart home care system and this system can be supervised by the doctors mentioned as medical monitoring, by any chance of emergency, the health data of patients can be obtained from medical monitor. From the figure 4, the sensor can collect the data for representation from the context database. Context reasoning is used to calculate the outcome. Rule based modeling can create the rule for elder person about their daily live home monitoring and in case of any emergency situations in daily live the person can sent to the medical care and normal and abnormal conditions are saved in the database. For example, takes an attributes like, oxygen leakage, usual and unusual breathing of elder person and respiratory rate, through base station and medical monitoring system caregiver can gather all the information. From the medical monitoring it will accumulate in the medical database for forthcoming use.

VI. CONCLUSION

In this paper, proposed on Context Aware Smart Home Caregivers System (CASHCS) on the basis of IoT, Context awareness generates contexts for determined problems as well as renders to caregivers. In this paper, proposed a system for elderly people signs monitoring and critical health conditions which is sends to the caregivers to identify the daily activities by using internet of things (IoT) this can be done in real-time. We have build a fuzzy logic from the beginning of data acquisition, processing of the data namely filtering, aggregating it into contextual information and reasoning to identify the elderly people health condition. Variety of connected devices can modify the remote characteristic, real-time monitoring, measuring and transmitting numerous body health parameters for making the decision and medication. The goal of this paper is to introduce the approach Context Aware Smart Home Caregivers System (CASHCS) to identify the usual and unusual situations of the people health status so that doctor can cure the problems in early stage without any complication. This can be used to generate a context-aware healthcare application framework. CASHCS is used to collects elder people health data and daily activities in real-time and usual and unusual situations of the person through MQ6 sensor. The users can obtain the information moreover via REST web services or wired.
REFERENCES