MEDIATED COMMAND AND CONTROL FOR SMART HOME

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ABSTRACT

The new paradigm of smart home is to view the smart home as the composition of living processes interacting among themselves or with the environment. The active environment can manage the environment with sensors and controls in a pre-specified way. In this paper, we view the environment is implemented with physical sensors and info-sensors. The info-sensor is the distillation of information from internet for providing alert, warning and reminding to the living processes. In this system, a living process engagement room is developed as a centralized tool for all the family members to interact, communicate and find resolution. The physical and info-sensors are all connected to the LPER, all the controls can be activated or reactivated from the LPER. There are other channels in the LPER including chat space, map and video space, note, and time-context space to provide warning and alert of those time-sensitive items such as bill-to-pay, doctor appointment, trip schedule, etc. The LPER architecture is therefore provide an innovative method to build smart home that support living processes of home owners, regardless if they at home or stay outside.

KEYWORDS: Living process smart home, context-aware, engagement room, LPER, smart home control.

1. Introduction

The living process smart home has received more attention in recent years. The recognition that in a smart home, not only the interaction is between the people living in a smart home and its environment, but also the interaction between people would need to be attend to by the smart home. The traditional objectives are to design the smart home for

energy saving, security, ease of control of the connected equipment's and appliances are now insufficient.

The researchers started addressing this issue by considering some limited combination of interactions of family members in the smart home [1] and try to determine the combinations of their needs that can be satisfied by the smart home control system [1-5]. The issue of living process is relatively new. The research done in this area is quite limited.

In this paper, a new innovative social media engagement room, LPER (Living Process Engagement Room), is proposed to execute the consensus agreement or mediate the conflict requirements in dealing with a critical situation so that the home owner can activate the control to solve home-related problems. This mechanic of receiving all sensor signals and info-sensor alert and warning allowing the home members to communicate and agree on a response to those events has not been proposed by the previous published research papers in this area.

2. Previous Work

The living process is also partially recognized by [1-6] as the Activities of Daily Living. Other related work [1, 3, 4] attempts to collect the statistic of the activities occurs in various rooms in a smart home so as to understand the ambient living context. The proposed system mostly for adult care and users can send queries in terms of activities and location (which room) in the house. The context awareness is built on top of the commercial sensor by which the sensor itself cannot provide rich context awareness. Kulthavarakorn [6] has also proposed a context-aware living process smart home in which physical sensor array and info-sensor together with time and living process provide a context rich system to enable control the interaction with smart home environment and the interacting processes of living together in the smart home environment. The overall architecture of the system, as shown in Figure 1 requires a central channel called Living Process Engagement Room (LPER) to empower home owner to take the decision together. The details of LPER will be presented in this paper.

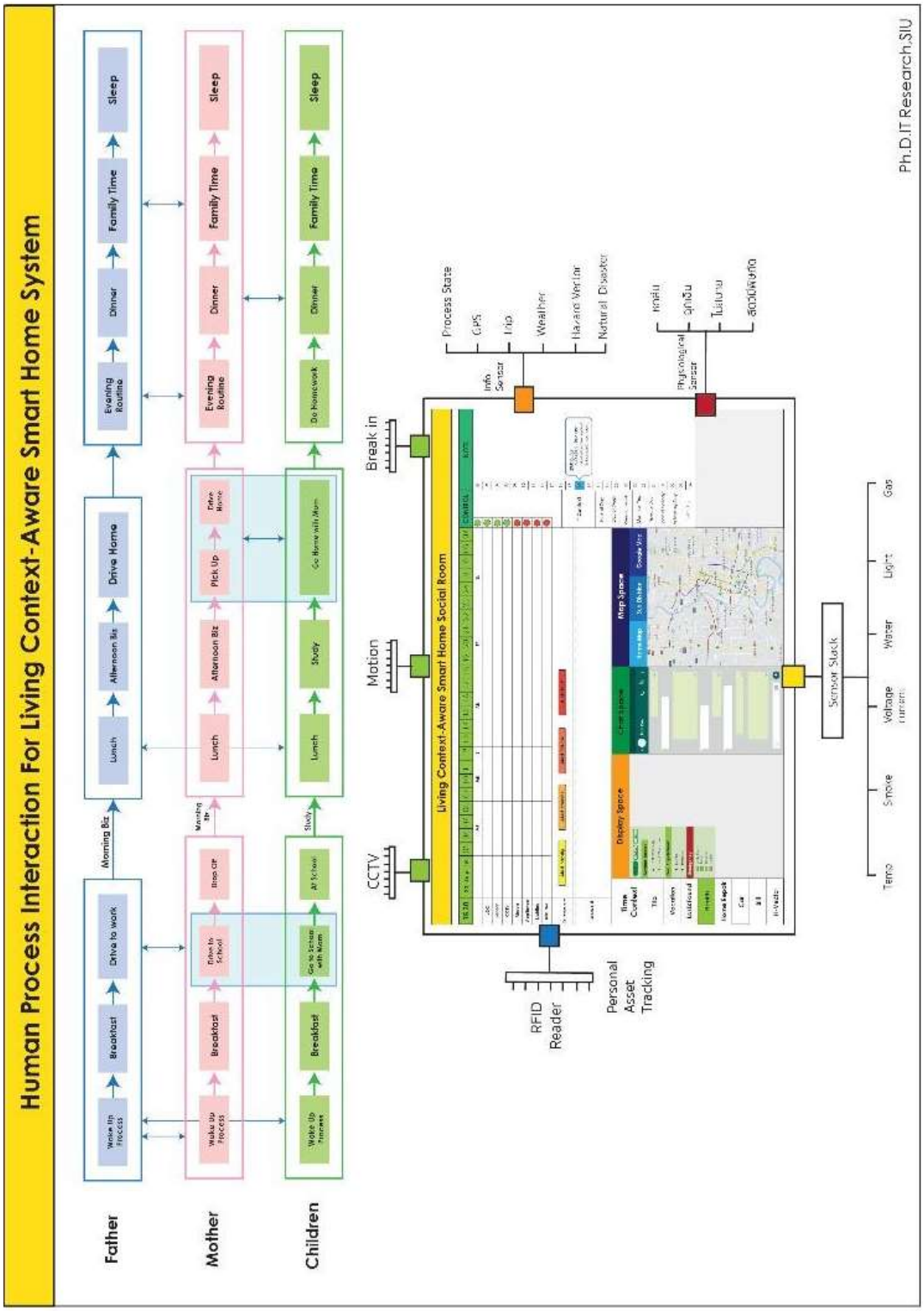

Figure 1 The living process interactions.

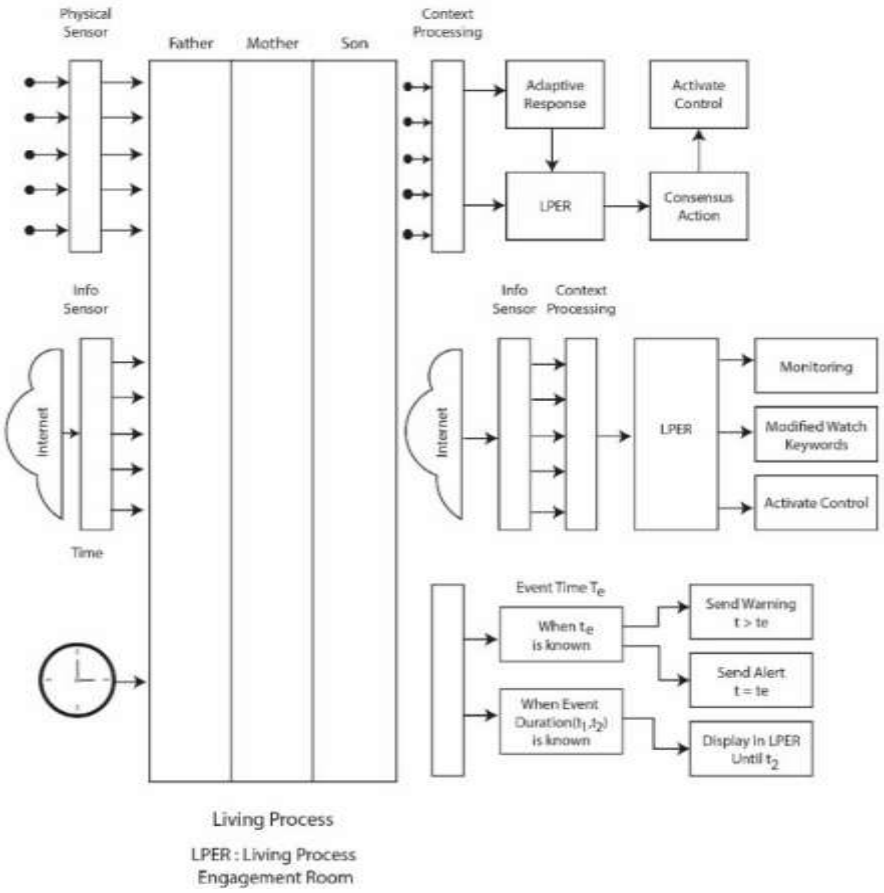

Figure 2 Smart Home Architecture with Living Process Engagement Room.

3. Smart Home with Living Process Engagement Room

This section will give a brief review of the context aware living process smart home as proposed in [6]. In this design, Shown in Figure 2, the context is provided by two sensor arrays, one physical and one informational, the time, and the living process. The idea is that home owners and home are inseparable, must be in constant interaction through sensors and appropriate actions must be taken within the specified context. The Live Process Engagement Room is an interactive dashboard for all family members to interact and provide consensus for any action that necessitate from the event at the home side or from the family members side. The input from sensors will be processed under the contextual information such as time, state of the sensors, the whereabouts of the home owners, and initial adaptive response can be activated as the first line of defense. The information will appear on the

LPER and the family member can reach a consensus the perform countermeasure action to alleviate them or solve the problem. The system is design such that many time sensitive items, such as doctor appointment, time to pay bill, trip time, etc., in the household can be set such that warning and alert can be sent the LPER to remind the family members for action. The architecture of LPER is implemented in the Context-aware smart home.

4. LPER Process

In the Living Process Smart Home, the number of combinations of context activities comprising family members, number of rooms, time of the days, and different context requirements, are exponential in complexities. As in many papers, the enumeration of all the living interactions in the smart home environment can be daunting task and lead to a very limited model and it is extremely hard to extract any useful results or insight. Our approach to resolve the interaction between living process and between living processes and the smart home, we propose a centralized mechanism called LPER, which is a social media operation dashboard shown in Figure 3 The structure of the Smart Home Engagement Room consists of four components as follows.

- Sensors Swim Lane: sensors array versus time of day.
- Family Emergency Lane: to manage emergency events, alert and warning, chat, locations, taking notes.
- Control Lane: to manage sensors, lighting, security, appliance, cctv, microphone, fire alarm, and all the controllable devices in the smart home.
- Time-context Lane: to manage time sensitive items related to household activities such as trip, vacation, lost & found, health, home repair, car, pay bills.

Figure 3 Layout of the LPER, social media interactive engagement control.

The sensor swim lane interfaces to the sensor array installed at the smart home. The on-sensor signal will be shown and the first line of defense will be activated. The home owners can use the action lane to devise any counter measure to activate or deactivate and controls in the control lane. Family emergency lane comprising alert functions, chat, location display, and control activation as needed or decided.

For the processing of time-context item such as trip, vacation, lost & found, health, car, bill, H-vector. H-vector or hazard vector such as direction of flooding that potential can be near the smart home as traced by the info-sensor., and hence warning is needed.

Let us define the time duration of each item, t1 be the beginning of an event or activity associated with that item, for example, the payment date. Let t2 be the last day of that activity such as the last day to pay the bill without penalty. For lost &found, t1 is the day the item is lost, and t2 is the day item is found. If item is never found, then t2 is infinity. For H-vector, t1 is the first report that a H-vector is defined, and t2 is the date that H-vector is harmless or action must be taken to avoid the harm caused by that hazard.

Let d1 be the time to issue the 1st warning, d2 be the time to issue the 2nd warning and d3 be the time to issue the 3rd warning, $d1 < t1$, $t1 < d2 < t2$, and $d3 = t2$.

Procedure: LPER process

If home sensor-detection on then send message to sensor-swim-lane at time t,

If message on LPER then

1. Activate alert to family, friends, police or PQR,
2. Use control lane to control home system remotely
3. Use Note to record the action and memo.
4. Chat to consult family member for consensus
5. Use Map Space to see the location or video from smart home.

For the Time-context items (with local t1, t2, and di)

Case of trip or vacation:

if time is d1 and checklist incomplete

Then issue warning to complete the checklist.

If time is d2, then check to get trip status.

If time is d3, then check to confirm returning.

Case of lost and found:

if lost at time t1 then d1=t1, define d2

if found at time t2 then d2=t2, chat thank

if time is d2 then issue warning.

Case of health:

if time is d1 then issue warning about appointment

if time is d2 and not seeing doctor, then suggest reappointment

Case of car:

if di, i=1..3, then issue warning for paying installment

Case of bill:

if di, i=1..3, then issue warning for paying bill

Case of H-vector:

if info-sensor forms a H-vector at time t1, then d1=t1, and define di, i =1

do until (H-vector is no longer a threat)

If time is di, then issue warning,

i=i+1, define di

end

5. Conclusion

The living process of a smart home is the key concept that will influence the design of the next generation smart home. To manage the interaction of living process in a smart home, a central mechanism is proposed to support commination and event management. This paper has proposed, LPER or Living Process Engagement Room, as a device to support the interaction between living processes and the smart home. LPER layout is shown in Figure 3. The four lanes of the engagement room provide home owner ease of mind in connecting to the smart home all the time, and also connect to all the family members, with capabilities to provide counter measure to solve some major problems arisen un-forecasted. The system is implemented on PC and on android. In the Android implementation of the LPER, the four lanes are separated into four pages. The system's database is tested on the PC as it is used for all the setup and provides the connectivity to the control arrays at the home side, the info-sensor data is routed separately to the PC and android system.

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