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Survey on IoT Enabled Patient Assisting Devices

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Abstract: As in this busy world today the people are unable to remind the correct time for the medications which are putting them in difficult situation. To overcome this forgetfulness to take medicine we have been many reminder device to give support the people in healthcare has been developed. This includes automatic reminder systems, KIT used in Ambient Assisting Living. Since the medication should be taken in presence of medical caretaker in case of dementia the reminder system also used different sensors and camera for information gathering on taking dosages. Even few of android devices are being available for the reminder system.

Keywords: Reminder system, Ambient Assisting Living, Android, IoT

I. INTRODUCTION

The Internet of things is the inter-networking of physical devices, vehicles, buildings and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. So using this growing technology there have many devices that have been developed for the patient assistance in the field of healthcare and medicine.

II. RELEATED SURVEY

In fast moving world today, busy schedules and priorities people have a habit of forgetting things in rapid. In context of this the elderly or the patients are also forgetting to take medication at prescribed time due to which the patient suffering from illness can be cured in more time than the time expected by doctor as per his prescription. According to a survey only we have observed that only fifty percent of the people follow the medication intake as prescribed by the doctor and receive the full benefits [1].

Medication Adherence using a hybrid automation reminder machine can be used to remind the patient based on the schedules as defined by the user input. The hybrid automation reminder machine was developed in order to handle both the kinds of pills i.e. a single medicine or a medicine / powder bag i.e. different medicines one after the other. This system consisted of two systems in the hardware architecture i.e. 1. A Reminder Machine – Which consisted of MCU, Bluetooth module, medicines, LED display, buzzers, stepper motors and the buttons. Using the button it was enabled to set the time and the type of pills. In order to provide the user with medicine /powder bag i.e. one medicine after another the stepper motor was used for rotation. 2. A Bluetooth bracelet – Which consisted of a Bluetooth module, buzzer, LED display and MCU. Firstly the time for intake of medicine was set in the Reminder Machine using the buttons. When it was the time to take the medicine it would send message to the Bluetooth bracelet using the Bluetooth module which is prototyped. As soon as the Bluetooth module received signal the led and the buzzer would get activated. Then the user should come to the reminder machine and press the button. It checks if the user has pressed a button and allows the user to select the type of pill i.e. if a single medicine, the medicine is despatched and process comes to end. If it is an medicine / powder bag the motor starts rotating to dispatch medicines one after another. If the user did not press any button when the buzzer rings then the machine waits for one minute and terminates the process. The main disadvantage of this machine is that the Bluetooth module is stipulated only for short distances and if the user wearing the Bluetooth bracelet is away from the reminder machine then the braclet does not gets activated and hence it does not notify the user [2].

Ambient Assisting Living (AAL) aims in providing technical system to provide the helping aid to the elderly in their daily routine. In order to achieve this an instrument called KIT i.e. Keep In Touch was developed using smart objects and technologies to facilitate tele-monitoring system. The KIT facilitates in Closed Loop Healthcare Service to process the relevant data and establish communication between the elderly and the physicians. This used two methods, 1. Keep In Touch; 2. Closed Loop Healthcare Service. Keep In Touch and Mobile phone uses the NFC i.e. Near Field Communication and Radio Frequency Identification for exchange of data. Initially the KIT consists of medical equipment and the measured quantity is entered to mobile through the NFC – is a wireless connectivity technology

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based on magnetic inductive coupling which works in free frequency band of 13.56 MHz. Later using the Closed loop Healthcare Service the data is sent to the telemonitoring service center when the data will be stored and the physicians can view the data in order to optimize the treatment for the patient. The Telemonitoring System also sends reminders for patients regarding the health. The main disadvantage in this is that the mobile and KIT should be in a touch i.e. should be in the desired frequency band [3].

Due to forgetfulness, people with dementia need assistive technologies for managing medications. In this paper we present a Kinetic based system for medication adherence monitoring of people with memory-degrading conditions .our system not only reminds a patient on time of medicine intake and provides the corresponding medication dose, but also vocally guides the patient through the steps of medication intake, controlling correctness and completeness of his actions and alerting the caregiver if problems occur.

This system consist of two main units, 1.The dosage unit stores medication doses, present by the care giver. It consist of compartments, each compartment can accommodate different types of pills to be taken simultaneously as a medication dose. The compartments are labeled by marks corresponding to morning, noon, and bedtime . In order to assess and supervise the patient's activity, the system contains a visual sensor (Kinect), speakers, and an array of simple Reed-switch sensors, micro-actuators, and LEDs. The Reed-switches, sensors, actuators and LEDs are built in the dosage unit and 2.The PC is programmed such that it can perform many functions like remind the patient about time of medication intake, set medication doses and time schedule of their intake, guide the patient through steps of medication intake by vocal prompts. Kinect is the vis and the speakers are directly connected to PC. The results of monitoring the patient's medication adherence are stored in system database and can be viewed online from PC or online from the caregiver's personal device. Here the system consist of some more hardware like the prompt generator works as a look-up table that maps the prompt codes produced by the medication adherence controller to vocal commands delivered through the speakers to the patient, the message generator maps message codes produced by the medication adherence controller to messages sent to caregiver through email. The system interface provides the caregiver simple interface to fill-in the medication doses, set a schedule of their in-take, and view the history of medication intakes over the given period of time. The medical adherence controller is implemented in software on PC. It takes the medication schedule from database and data from the dosage unit sensors and Kinect and based on them assesses the patient's actions, generates control signals to open the required dosage unit compartment, determines the codes of prompts and messages to be send to the prompt generator and the message generator, respectively, and writes the results of adherence monitoring in database. The system operates as follows. By using the system interface, the caregiver unlocks the dosage unit, fills medication doses into compartments and sets up the intake schedule. As the schedule is saved in database, the compartments are automatically locked. When the time comes, the medication adherence controller unlocks the compartment with correct dose, activates the prompt generator to vocally remind the patient to take medication, and initiates the patient's monitoring by Kinect. To help the patient to find the required dose, only LED of unlocked compartment is switched ON , while all the other compartments are locked and have their LEDs OFF. As the patient opens the compartment, the system vocally prompts him/her on correct steps of medication intake. If it recognizes that the patient completed the intake activity successfully, it sends an informative message to the caregiver. Otherwise, it prompts the patient again to repeat the uncomplete actions (e.g. intake the medication; close the compartment, etc.) If after several reminders the action remains still incomplete, the system alerts the caregiver about the problem by a corresponding message, switches the LEDs OFF and returns to the schedule monitoring. The proposed system still suffers from common limitation of camera-based intake recognition systems. Namely, it does not distinguish the actual medication intake from touching mouth or nose for example, The swallowing of pills is not detected per se, since Kinect camera resolution does not allow it and it is also restricted ourselves to monitoring of a single person [4].

Thai is very well known for ageing society status so, they proposed a architecture which incorporates a combination of automated process technique, which are Voice over IP, SMS and web services which helps to devise an effective remainder and feedback solution for both Thai elders and supervising healthcare professionals. It is easy to use, reliable and flexible for future change if needed. It is use by more generic Thai elders and not only those who are familiar with it. It is also capable for reminder system for the elders and a feedback system for healthcare professionals. The development and test platform (32-bit, i386 desktop) ran the Ubuntu 11.10 operating system with 4GB of memory on the Intel Core i7 processor with L3 cache. The whole project was ran together on a virtual machine an i386 Ubuntu Server 11.04 with 1GB of memory. The early version of a VoIP server was provided by a commercial VoIP service. The SMS service was used to allow easy integration throughout the system. A preliminary study is needed so they planned to use smart phone for reminder and feedback in collaboration with Primary care unit (PCU). That time Siriraij Hospital was one of the largest Hospital for public so they performed under this hospital there experiment. First a prototype of a smartphone based on medication reminder and feedback system was developed and given for initial test to the Siriraj PCU. But durinf this phase, the PCU staffs expressed their concern regarding complexity and high cost of smart phone which is not affordable for all kind of patients. A complete solution of medication reminder and feedback system of non-smart phone does not only depend on system architecture but also on user-friendliness of the non-smart phone device as well as efficiency of communication to the end-users. Some of the studies also suggest that the keys, screen, font should be clear enough to use and Thai language should also be supported for Thai people as everyone in

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not verse in all language. Communication should be simplest if not most elders will lose their interest and this will cause the failure of this project. One more issue was identified is that the VoIP server was rather limited and it can make only about five phone calls. So we need more powerful VoIP server along with an efficient reminder scheduling policy to manage schedules [5].

Medication Reminder and Healthcare is based on the android application. With the present fast moving life with stress, people are usually suffering with one or more diseases. To overcome from deadly diseases one important task is to take the medicine regularly. The medication adherence as become the most complex task. So to overcome through this difficulty the new system should be developed. With the wide use of gadgets gave the opportunity to develop new application. So using these android gadgets the difficulties faced with medication adherence as been overcome. The android operating system is mainly used to improve the technologies associated with android mobiles like touch screen application. Android application is the Linux based system. Using this android application the users (user may be the patient who wants to use this app) can register, can set the alarm, enter the start and the end dates through the app, users can also select the doctors based to the diseases through navigating through the many existing doctors. The users can also read the other articles, different post which is related to the good social life style, looking and feeling better and happy healthy life. Once the alarm is set the users get the notification messages via mails, messages which the user are selected. The user can activate or deactivate the notification based on the user preference.

The Doctors can register using the registered modules through which the doctor can enter the details. Even the doctor can view the details and information about the entire registered user. Appointment scheduling can also be done through this app. Still the developers are working on this system to improve the interaction between the user and the doctors through the video calling [6].

Usefulness of health care services is seriously affected by medication adherence. Internet of Things (IoT) infrastructure for activity monitoring is a strong candidate solution to maintain adherence of forgetful patients. In this study, we propose an IoT framework where medication intake is ensured with real time continuous activity recognition. We present our use case with the focus of application and network layers. We utilize an activity classification scheme, which considers inter-activity detection consistency based on non-predefined feature extraction as the application layer. The network layer includes a gateway structure ensuring end-to-end reliability in the connection between a wireless sensor network (WSN) and Internet. Results obtained in simulation environment suggest that the selected application and network layers introduce a feasible solution for the medication intake use case. GlowCap, a Vitality product, is designed as the lid of medicine bottle. A led flashes when it's the time for medication intake. If the monitored person forgets to put the lid on, an audio notification is generated and records that medication intake is complete. Over the AT&T Mobile Broadband Network, reminders, reports and notifications can be sent to the users and their caregivers. It's also possible to generate textual notifications in the case of forgetting medication intake or phone calls for the monitored person. However, for this system to fulfil the defined functionality, the medicine box and the led equipped apparatus which is plugged into the outlet should exist in a place, which is visible for the monitored person. We carried out our tests related to activity recognition phase of our medication intake adherence framework, splitting the composite medication intake activity into simple actions drink, open-pill-box, put-glass-back and put-pill-in-mouth. Part 1 comprises taking the pill from the box whereas part 2 is moving the pill towards the mouth. Durations of the activities drink, open-pillbox, put-glass-back, and put-pill-in-mouth are determined to be 7.83 s, 2.71 s, 1.96 s and 3.70 s respectively. The human subject is told to perform these activities conforming to the given durations. Audio notifications are provided with the human subject so that he can conform to the given durations, however, the performed duration of the activities by the subject do not correspond to the specified durations exactly. The specified durations of the activities are set as given due to their suitability, which is established upon practicing the considered activities. Given duration of the activities are also utilized in simulation tests of the gateway, to evaluate gateway response time. Medication adherence is an essential component for achieving effectiveness in health care services. Though some patients do not adhere to the therapy on purpose, the rest suffer from accidental non-adherence. Medication intake is one of the cases which require adherence and forgetful patients may fail to adhere accidentally. Existing tools to assist forgetful patients in adherence are disadvantageous since they determine medication intake is fulfilled, considering indirect indicators of medication intake, instead of directly monitoring medication intake activity. They also do not operate on IoT and can e-Health Pervasive Wireless Applications and Services (eHPWAS'15) 236 be in scalable for increased number of medication items [7].

CONCLUSION

We hereby after surveying the papers published before conclude that only 50 percent of the people take intake of medicines as prescribed by the doctor in the correct time. And there was no system which can maintain the temperature inside the box. As the person can move from one place to another the temperature and humidity does not remain same which has to be maintained in order to maintain the potency of the medicine. There is no information stored on the cloud based on intake dosage, remainder system were based on Bluetooth modules which is only for small radius distance.

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