Design of Health Informatics Solution Supporting Disease Management of Elderly Suffering From A Chronic Disease.

SSY115 - HEALTH INFORMATICS

Home Exam

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Abstract

Chronic disease is the leading cause of hospitalization worldwide which at a late stage may lead to death and account for disability. It is roughly estimated that chronic disease constituted about 73% of all deaths during the year 2020.Some of the prominent chronic diseases are cardiovascular disease, type 2 diabetes and obstructive pulmonary disorder.The major physiological parameters for diagnosis of these diseases are notably blood pressure and cholesterol.The rootcause for change in these parameters is known to be affected by physical and behavioural changes like overweight, tobacco use, unhealthy diet and minimal physical inactivity.Surprisingly, these factors can be well-controlled through proper analysis of the key risk factors in a well-integrated manner[1]. This information is required to give an overview of the digital solution aimed to aid people diagnosed with the disease along with the the aims and limitations of the proposed solution.

The aim of the proposed solution is to monitor patients at home and assist with their daily living who has been diagnosed with chronic disease. The solution covers target group from 75 and above who are well versed with basic operations[1] on their smartphone.

Also,the given solution can be implemented only on a smartphone.This solution can only be used as a monitoring device so as to be in accordance with suggested medications, diet and other treatment options as adviced by the healthcare professional.

Keywords: Chronic disease, diabetes, blood pressure, cholesterol, Congestive Heart Failure (CHF), eHealth.

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[1] Read/send messages, call, App usage

Contents

List of Abbreviations

AI   Artificial Intelligence

BP   Blood Pressure

CHF   Congestive Heart Failure

ECG   ElectroCardioGram

EHR   Electronic Health Record

EU   European Union

GDPR General Data Protection Regulation

OS   Operating System

SSN   Social Security Number

1 Proposed eHealth solution

1.1 Persona

Figure 1: Image of the persona

Name	Merlin Karlsson
Personal Details	77, retired, lives with wife in Gothenburg, avid book reader,
Likes to	lead stress-free life, be physically active during day.
Recently experiencing	Memory loss, mild tremors, anxiety
Diagnosis	Stage C Congestive Heart Failure [2] in 2019
Health advise	continue medications prescribed , Low sodium diet,weight,blood pressure and diabetes to be in control, 30 min mild activity like walk, breathing exercise everyday.

Table 1 - Persona details

1.2 Part 1: Technical approach and system solution

Based on the persona details given in table 1, the best approach would be first to collect a requirement list to monitor the required physical and physiological parameters from the patient on a regular cycle or as advised by the physician.Table 2 gives a list of already available devices on market that can be used at home as a self-tracker tool to effectively measure these parameters.Most of these devices use bluetooth to pair with a smartphone to record/transfer data and further analysis is made.

Parameter to be measured	Device used	Available devices	Frequency of measurement	Measurement mode
Heart activity	ECG	Zenicor pocket ECG, XIAOMI Hipee 24-hour Smart Dynamic ECG Monitor,	As advised/ Automated	Manual
Blood pressure	BP monitor	OMRON,Beurer, Braun	Daily	Manual

Diabetes	Diabetes monitor, Glucose monitoring apps	Dario Health,OneTouch Reveal, Glooko	Daily	Automated
Weight	Smart Weighing machine	OMRON VIVA, Xiaomi MI body composition Scale 2	Daily	Manual
Diet	Smart watch, Apps	FitBit, Apple smart watch, Xiaomi MI band,myfitnesspal ,Lifesum,Fooducate	Daily	Manual
Mood changes	Smart watch, Apps	FitBit, Apple smart watch, Xiaomi MI band,iAura, Mood Scanner,Mood Reader	Daily	Manual, Automated
Dedicated physical activity	Smart watch, Apps	FitBit, Apple smart watch, Xiaomi MI band	Daily	Manual, Automated

Table 2 - Requirement list and available devices on market

While most of these devices either require the data to be fed manually or sometimes mix of manual and automated data transfer, ideally a patient of old age would require an automated data transfer to enable easy accessibility.

It is required to enable constant monitoring of data due to age factor and any abnormal reading should be notified immediately.So,the best solution is to integrate all these technologies on a single device built with sensors that can collect data constantly like blood pressure, heart activity and glucose using body's fluid. This can be a skin patch that can be worn around arm, neck or hip regions. Automated data transfer happens via bluetooth which is automatically paired with the smartphone and fed into the app. Other details like food, weight and amount spent for daily activity along with behavioural changes is recorded using voice or a scanner. Also, it is recommended to use assistive technologies like electronic keys and night surveillance system for elderly [3]. This way the patient is constantly monitored and any deviated data is immediately brought to notice to a dedicated healthcare team.
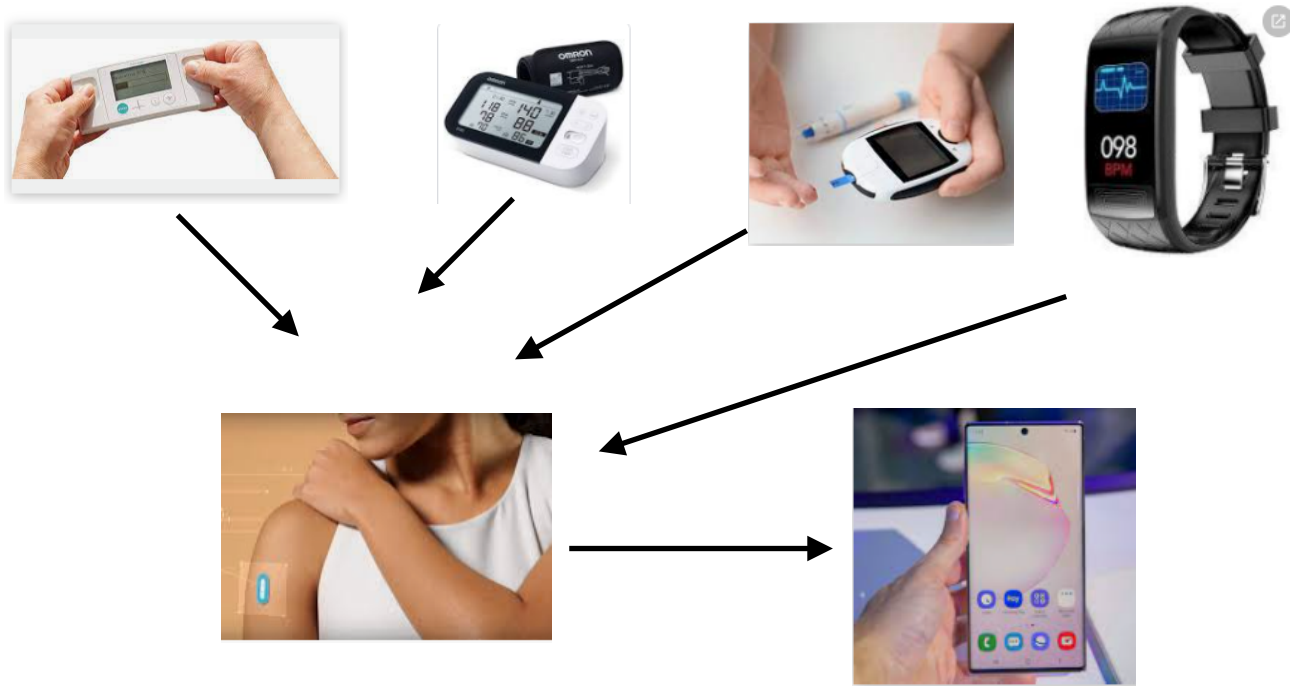
Figure 2 - Integration of all devices on a single device with a smartphone

1.3   Part 2 : Design and Implementation

The following table 3 gives a simple design idea and how the eHealth solution can be implemented and followed for constant monitoring. On diagnosis of a chronic disease,the patient is advised with medications, diet to be followed with low sodium and dry weight of the patient to be monitored at same time everyday, 30 minutes of mild activity like walking, deep breathing and very simple exercises advised with a breakup of 10 minute schedule everyday. Since the persona given is in need of physically active engagement during day, this is also taken into consideration during the design process.

Step	Process followed	Implementation
1.Installation and Login	Post diagnosis, patient is advised to install app either by himself or by a healthcare professional using his personal number (SSN) and BankID.	• Minimal cost during trial period. • Cost increases as number of symptoms to be monitored increases.
2.Device pairing	Post installation and Login, device is handed over to patient and paired with smartphone	• User profile created with EHR data of the patient. • Centralized repository. • Once device is fitted, automatically paired with smartphone via bluetooth.

3.Features in App	Medication reminders, alarm to fit the device for monitoring, enter activities completed and e-Books , news, articles, public forum, technical live support 24 x 7, stress buster activities with AI technology.	Medications and time schedule pre -fed into the app.
3.Data collection, transfer, analysis and reporting.	• Instruction given to patient on how to fit the device and location. • Automated data transfer happens. • Medicaton reminders, weight measurement, diet and dedicated activities to be fed by patient manually.	• All the data like medications prescribed, diet, blood pressure, heart activity and glucose levels to be miantained fed by the doctor. • This will be used to compare against the data collected frequently through Machine Learning techniques.
4. Post analysis/ Deviation in data	Data collected fed into the app and stored for analysis	Abnormal deviation in data with tolerance level is alerted to healthcare team and patient called immediately for further analysis and treatment

Table 3 - Design and implementation of proposed eHealth soltuion

1.4   Part 3: Legal, safety, ethical and privacy issues [4]

• Based on the guidelines issued by Mediccal Products agency, the device and the software developed falles under the Medical Device Software Category. Therefore, CE marking of the app and device is essential as it is intended for medical use and diagnosis by the healthcare system.

• Also, all the data collection and transfer will happen as per the GDPR guidelines followed in EU.

2   Discussion

Although the proposed solution looks feasible, it depends on the patient's comfort factor for daily usage and not everyone finds it affordable due to cost factor and upgradation of technology. Also, the efficiency of the smartphone like battery charge, security and data leaks, network connectivity, synchronization with all OS, data storage should be considered while design of the app and device.

3   Conclusion

eHealth solutions is one of the currently booming fields in the healthcare sector covering almost quite a large number of disease ratio in various aspects. But,a single solution to cover a broader spectrum is quite rare while a lot of scientific research papers is available to study and implement the same. It can be concluded that there is a lot of scope for improvement in future with regards to eHealth solutions to assist with Chronic disease.

References

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[4] *https://chalmers.instructure.com/courses/13337/files/1281122?module_item_id=168380*