

Telemed-care, an Advanced ICT Platform using Facebook, Apps and Web-Technologies for Telemedicine Purposes

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Abstract: This paper deals with a telemedicine system called Telemed-care with its own software part named Care-app, designed by the author. The platform is suitable both of them for personal computers and for mobile devices (tablet and smartphone), and properly uses all the well-known Facebook facilities, smartphone's apps and web-apps, to support the execution of remote medical visits.

Telemed-care aims at the home healthcare (homecare) including the tele-auscultation in real time already successfully validated by the heart specialists of the U.O. of Cardiology in the general hospital (Polyclinic) of the University of Bari. This paper describes the platform features and capabilities with a remote medical visit procedure.

Keywords: Social network, Facebook, Telemedicine, Aemote medical visit.

1. INTRODUCTION

The most recent developments in the field of electronics, informatics and telecommunications let imagine applications in the telemedicine and home care field that could mark a turning in the quality of the services for sanitary assistance, prevention and care [1].

It above all deals with home care services of chronically ill patients or patients afflicted by pathologies (such as cardiac decompensation or obstructive chronic bronchopathy) for which the home monitoring can often substitute the hospitalization with significant advantages in terms of the patient's quality of life and of sanitary expense saving.

Although there are already available instruments for the remote monitoring of the Electro Cardio Gram (ECG) [2, 3], the need is felt of reliable telemedicine devices allowing remotely the follow up of chronically ill patients. In fact, despite of the significance number of experiments, nowadays easy-to-use and low-cost telemedicine systems allowing the remote execution of complete medical visit, including the most significance examinations, using personal computers, tablet PC and smartphones are not available.

The most recent trend toward the massive use by people of any age of the social networks, Facebook above all [4], and of the smartphone apps and PC web-apps, gives the right support to create an ICT

(Information and Communication Technology) platform useful for homecare purposes.

Therefore, the author has developed such a platform, named Telemed-care, whose software part has named Care-app.

The author already has proposed the general guidelines about the use of social networks, apps and smartphones for telemedicine purposes and the main features and functions of the software Care-app [5]. In this paper, the author describes the complete Telemed-care system and a detailed procedure to perform a remote medical visit using Telemed-care.

2. MAIN FEATURES AND CAPABILITIES

As previously stated, Telemed-care is a medical electronics and informatics platform for diagnostic use, which permits the doctor to carry out a complete cardio-respiratory control on remote patients in real time. Both, the doctor and the patient, should use personal computer or tablet computer or smartphone. The operating system can be Android or iOS, indifferently. A powerful social network like Face book supports the platform to connect the doctor and the patient each other and to allow them to communicate quickly and to exchange privately, thanks to the privacy settings options, any kind of information, files, and so on.

It is possible to use any other social network in place of Face book, with slight modifications to the code of the software part of Telemed-care, called Care-app.

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The medical examinations are performed thanks to a pc-based medical instrumentation, whose drivers (apps) are also optimized for mobile devices.

Some web apps support the platform, for example: Healthvault [6] a free service/web app powered by Microsoft, medical advisor [7], google map [8] for urgent rescue of a patient suffering from illness, and so on.

The real time feature supported by Telemed-care means that, as if the doctor is present personally near the patient, the system allows the doctor to receive the data simultaneously at the acquisition.

The most relevant data/examinations are:

Auscultation of cardiac tones and broncho-pulmonary sounds;

Oximetry;

Respiration frequency and spirometry;

Arterial blood pressure

Electrocardiogram;

Image and audio of the patient, of professional quality

The platform is open to integrate easily any other instrument and/or utility for health data acquisition. The only one requirement is a proper app, optimized also for mobile, for each utility/instrument.

The main hardware parts of the platform are two terminals, personal computers (PC) or mobile devices, for patient and doctor respectively, equipped with the proper software Care-app, doctor side and patient side respectively.

It is possible the doctor uses a smartphone while the patient uses a tablet or vice-versa, or both of them use a notebook, or the doctor uses a tablet and the patient uses a smartphone, and so on.

Moreover, the patient position is equipped with miniaturized diagnostic medical instruments suitable also for smartphone and for pediatric use. It is possible to get any patient positions for only one doctor position.

Telemed-care is a modular and open platform. In fact, it allows the plug-and-play installation of further diagnostic instruments.

The ECG may be also recorded up to 12 derivations if the patient uses a personal computer (indifferently desktop or laptop). Moreover, the ECG automatically carries out the reading and the diagnosis of the tracing that the doctor has to reaffirm. It is possible to carry out ECG monitoring without time limits and always in real time. This makes possible the capture of uneven heartbeats or also intermittent ones of other nature. The acquired tracing is registered and filed.

The tele-stethoscope is electronic and captures the biological sounds in the band frequency ranging from 20Hz to 1kHz and can be used in three modes in order to improve the cardiac and pulmonary auscultation: membrane, bell and extensive mode. Moreover, it allows the 75% abatement of the external noise. It has a 3.5 mm jack for PC/smartphone connection.

It is equipped with software for the spectrum analysis in real time and it automatically starts at the beginning of the auscultation procedure. The positioning of the stethoscope is led by a remote doctor thanks to the full time audio/video communication powered by Telemed-care, and the biological sounds can be simultaneously heard either by the patient (or by a care-giver helping the patient in the completion of the examination) or by the doctor in remote. The social network Facebook provides the audio/video communication utility; it is enough to this aim to install the proper Facebook plug in. Alternatively, it is possible to perform high quality audio/video calling by other apps and web services as Skype [9], for example. The real-time transmission of the biological sounds has a dedicated codec, already successfully validated. Details about the design of the tele-stethoscope, performed by the author, and the validation results are in [10, 11].

The recording of the biological sounds in a file, during the acquisition, allows significant advantages in terms of accuracy of the diagnosis and in terms of possibility of carrying out diagnostic comparisons in the time.

The tele-spirometer allows to carry out the main clinically significant respiratory tests and to determine the respiratory frequency and is autodiagnostic.

The finger (optic) tele-saturimeter allows to carry out the monitoring (check without time limit) of the SpO₂ value as it is equipped with a plug-in allowing the tracing of a curve of saturation values in time function; the curve will be knowledgeable in real time and visualized by the doctor.

Further details about the most significant devices suitable for telemedicine applications and included in Telemed-care are in [6].

The doctor at the start of the visit creates a medical record (Temporary Electronic Health Record, TEHR) and opens it in order to record the data concerning the examination. The doctor can also prescribe other subsequent clinical tests advised and/or treatments to undertake by using the TEHR for the patient in visit, and send it to the patient at the end of the visit session.

In addition, the software Care-app allows the doctor to manage the Healthvault web service, powered by Microsoft [6]. The Healthvault service allows associating to each patient a clinical record with all the personal reports (clinical history).

In fact, this web service allows any person to have its own electronic health record (EHR) where any clinical information is stored, accessible by any web browser and protected by user login and password.

The doctor, at the start of the visit, looks at the EHR of the patient to know the clinical history and the most recent developments of the health status of the patient. Then, the doctor updates the Healthvault's EHR (HEHR) of the patient at the end of the visit in order to keep up to date the clinical history and the actual health status of the patient.

This kind of filing is also very useful to carry out diagnostic comparisons on the evolution of a disease or on the outcome of a therapy, and it eases the patient of the burden of bringing personally its own clinical documentation.

In the patient's database there is also a filed schedule containing the personal details of the patient, the case history in addition to various notes, values of blood tests, the outcome of other diagnostic tests, treatments undertaken during the time, therapy in course, etc.

Telemed-care also allows the transmission of echograms, X-rays radiograms/other tests in digital form to the doctor and the filing in the patient database. Once more, a web app is used to this aim. For example, there is Vueme app by MIM Software Inc. [12], suitable for smartphone. Alternatively it is possible to use a cloud service as google drive powered by Google [13], or Dropbox [14] or One drive powered by Microsoft [15] or others cloud services, to share and store medical images. Telemed-care is able to manage

any web service and web app by properly setting its Care-app software.

The doctor can also prescribe other subsequent clinical tests advised and/or treatments to undertake by using the TEHR and/or the HEHR of the patient under visit.

3. A REMOTE MEDICAL VISIT STEP BY STEP

The software Care-app manages very smartly and efficiently all utilities aiming at performing a complete remote medical visit.

Care-app makes the doctor and the patient very quick and easy to launch or kill apps; to start and end medical examinations; to switch from an app to another one; to come back to any previous step or to continue in the next step of the medical visit. Moreover, Care-app allows managing the Facebook utilities: "share", "message", "connect", "call", "friend", and so on.

Telemed-care requires a 320 Kb/s minimum band and a LTE/UMTS Mobile telephone is able to allow the execution of a medical examination.

The system has a user-friendly software interface, which implements the one touch philosophy.

Figure 1a, shows the main interface of the management software Care-app, doctor side, and Figures 1b and 1c show the main interface of the management software Care-app, patient side.

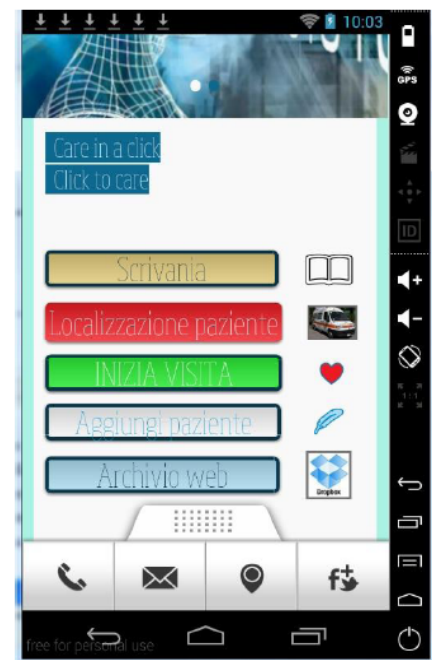


Fig. 1a



Fig. 1b



Fig. 1c

Figure 1: Software interface for the doctor position (a) and for the patient position (b) and (c) Translate the insets as follows: Figure 1a: “Scrivania” desk; “Localizzazione paziente” patient location (map); “Inizia visita” Start medical visit; “Aggiungi paziente” add patient (to the medical database); “Archivio web” Cloud web service. Figure 1b: “Le mie pillole” my pills; “Promemoria vocale” voice memo (reminder); “Richiedi visita medica” Request urgently a medical visit (examination); “Prenota visita medica” Book examination (medical visit); “Consulta medico” Consult doctor; “Chiedi soccorso” Ask urgent rescue; “Automedicazione” self-medication; “Trova clinica vicina” find nearby clinic. Figure 1c: “Attacco di panico” panic attack; “Medico in famiglia” doctor who; “I miei dati” personal main data; “Dieta giornaliera” daily diet; “Soccorso stradale ACI” street rescue (accident or breakdown).

The patient has many other very useful apps and facilities linked to its own main software interface: the pills diary, the rescue request, the find clinic utility, and so on, as shown in Figure 1c.

In particular, the patient can make an appointment for a medical visit (clicking onto the button “Prenota visita medica”, *i.e.* Book examination) or can require an urgent remote medical visit (clicking onto the button “Richiedi visita medica”, *i.e.* Request urgently a medical visit).

The patient can ask for urgent remote medical visit, as shown in Figure 2, by sending an SMS to the doctor or by calling (telephone) the doctor or by mailing him or by Facebook messaging.



Figure 2: Care-app, patient side, screenshot coming from clicking onto the button “Richiedi visita medica” (Request urgently a medical visit).

Translate the insets as follows: “sms medico” sms to the doctor; “Telefona medico” Call (telephone) the doctor; e mail medico e-mail the doctor; “Contatta via FB” contact the doctor with a Facebook message

If the doctor is available, the remote medical visit can start by doctor clicking onto the button “Inizia visita”, *i.e.* start visit (see Figure 1a), and the doctor can ask the patient to perform any necessary tests/examinations through a simple “click”, as will be better explained later.

The doctor, as shown in Figure 3, has a number of different options starting the remote medical visit. He should establish a Facebook connection with the patient if it is not yet running; otherwise, he should skip to the next step, as in Figure 3.

The doctor and the patient must be very careful, using Facebook, to properly adjusting the privacy settings in order to prevent someone from seeing the content shared privately between them, while the remote medical visit is in course.

Once the Facebook connection is running, the doctor should click onto the button “Osservazione del paziente”, *i.e.* Observation of the patient (see Figure 3), to connect with a high-resolution IP camera located nearby the patient.

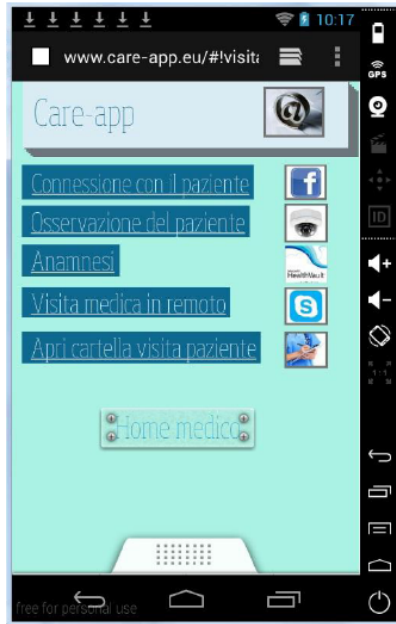


Figure 3: The options for the doctor when he pushes the “Start visit” button

Translate the insets as follows: “Connessione con il paziente” Connection with the patient; “Osservazione del paziente” Observation of the patient; “Anamnesi” Clinical history; “Visita medica in remoto” Remote medical visit; “Apri cartella clinica paziente” open Electronic Health Record.

The camera driver is managed once more by Care-app and then all the camera utilities are directly under the control of the doctor. Then, the doctor should exchange the target to see, start and stop a video record, take pictures by the webcam, and so on.

There are many options to establish the video connection, depending on the features supported by the IP camera chosen: by a cloud web service [16] or by a P2P connection, DDNS, and so on.

If the patient has not any IP camera, the appropriate Facebook plugin for video calls provides the video connection. Alternatively, skype [9] utility or Hangouts by google [17] are suitable to this aim.

As the doctor clicks onto the button “Observation of the patient”, Care-app automatically switches from one mode to another for video connection, depending on the availability of IP camera and on the plug-in for video connectivity installed on the patient side.

Once the Facebook connection is running, the doctor should also open the patient’s healthvault file by a simple click onto the button “History”, to know the clinical history of the patient and the most recent information about the health status of the patient, assuming the healthvault file constantly updated.

Moreover, continuing the visit as in Figure 3, the doctor by clicking onto the button “Apri cartella visita paziente”, *i.e.* “Open Electronic Health Record” should open, for the patient under examination, a medical record relevant to the current medical visit (TEHR).

Finally, the doctor should start to perform remotely the medical examinations clicking onto the button “Visita medica in remoto”, *i.e.* “Remote medical visit”.

If the doctor needs a quick, schematic summary of the clinical picture of the patient and details about its actual therapy, there is an appropriate tab in the software Care-app, patient side, as shown in Figure 4. The patient can send instantly the tab to the doctor clicking onto the “Facebook share” button located at the bottom side of the form (not visible in Figure 4).



Figure 4: Patient clinical data summary: a tab contained in the software Care-app, patient side. At the bottom of the tab, there is a “Facebook share” button useful for the patient to inform the doctor quickly about its own health status, current therapy, and so on.

The first utility for the doctor in order to perform remote medical examinations is the tele-stethoscope. In fact, when the doctor clicks onto the button “Remote medical visit”, it suddenly runs on its own terminal (PC or smartphone) the tele-stethoscope app for a real-time auscultation of the lung sounds and of the cardiac tones. Figure 5 shows the app interface of the tele-stethoscope.

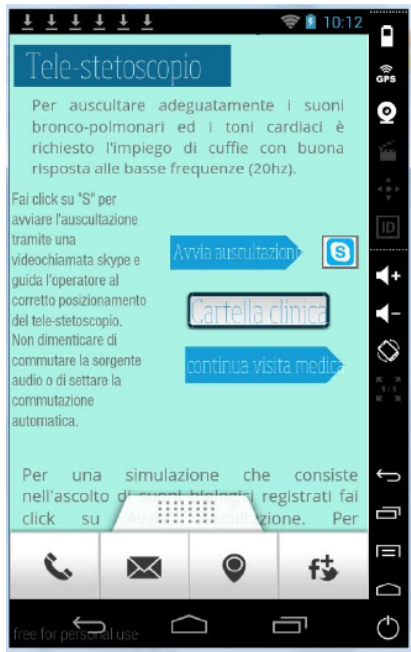


Figure 5: The tele-stethoscope app, from the Care-app, doctor side. Translate the insets as follows: “Avvia auscultazione” start auscultation; “Cartella clinica” temporary HER; “Continua visita medica” continue medical visit.

To start the tele-auscultation the patient has to connect the stethoscope’s jack into its own terminal (PC or smart phone). The doctor by a video chat by Face book or skype has to guide the patient or someone assisting him to the correct positioning of the stethoscope on the chest.

It is also possible for the patient to record the auscultation in a file and then send it to the doctor via e-mail or via Face book.

To this aim, at the start of the remote medical visit, the patient has to click onto the button “Avvia esami”, i.e. “Start examinations”, appearing on the patient PC or smartphone and provided by the main interface of its own software Care-app when he clicks onto the button “Require a medical visit”.

In fact, if the patient clicks onto the button “Start examinations” a menu like that in Figure 6 appears.

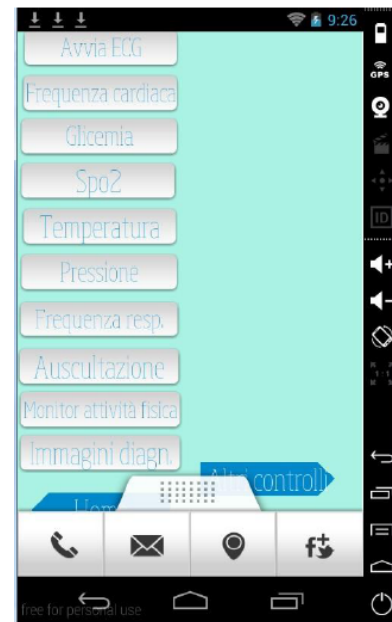


Figure 6: Patient side of the utility of the management software Care-app to execute the examinations. Translate the insets as follows: “Avvia ECG” start ECG; “Frequenza cardiaca” heart rate; “Glicemia” blood glucose; “SpO2” blood oxygen saturation; “Temperatura” body temperature; “Pressione” arterial pressure; “Frequenza resp.” respiratory rate; “Auscultazione” auscultation; “Monitor attività fisica” monitoring of physical activity; “Immagini diagn.” medical images.

In order to record the auscultation file the patient has to click onto the “Auscultation” button.

The auscultation is the most delicate step of the medical examination due to the difficulty in accurately convey the low-frequency sounds. Anyway, the tele-stethoscope and the related codec employed to this aim by Telemed-care, was already successfully validated by the author together with the physicians of the U.O of cardiology – University Policlinico di Bari, and full results have been already published in [10]. More details about the design of the electronic tele-stethoscope are in [11].

There are also in the applications store, some third-part applications declared by their own authors as suitable to perform the auscultation of the biological sounds but there is not yet been performed any validation. See for example [18-20].

Once the doctor has completed the auscultation step, he should open the TEHR clicking onto the button “Apri cartella visita paziente”, i.e. “Open TEHR”, shown in Figure 7a. Then, it appears the TEHR form as shown in Figure 7b, and the doctor can write notes about the performed auscultation in the field titled “Diagnosi e terapia”, i.e. Diagnosis and therapy.

After the heart and lung auscultation, the doctor should continue the remote medical visit. To this aim, the software Care-app, doctor side, gives the doctor a menu depicted in Figures 8a and 8b.

The most important examination in this step is the ECG.

As for the tele-auscultation, the doctor should view the electrocardiogram in real time or as a recorded file.

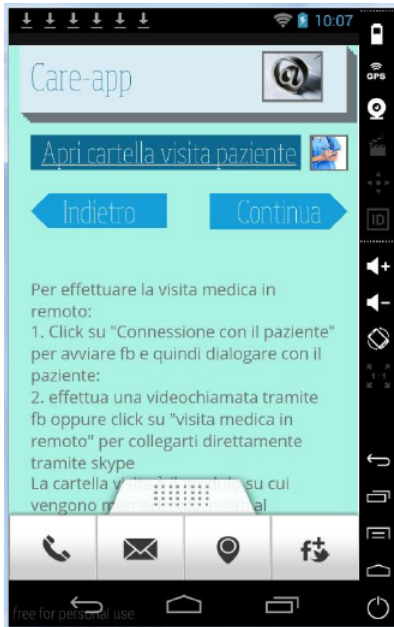


Fig. 7a

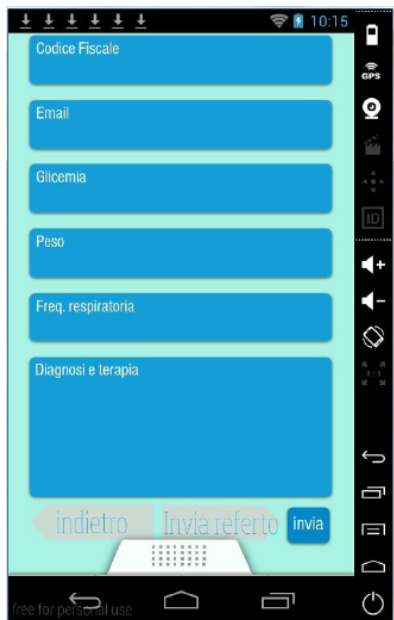


Fig. 7b

Figure 7: The “Open TEHR” button (a) and the actual TEHR form (b) used by the doctor as a temporary medical record for the patient under visit. Translate the insets as follows: Figure. 7a “Apri cartella visita paziente” open Electronic Health

Record (EHR); “indietro” back; “continua” next (continue). Figure 7b: “Codice fiscale” tax code; “glicemia” blood glucose; “Peso” weight; “Freq. respiratoria” respiratory rate; “Diagnosi e terapia” diagnosis and therapy; “indietro” back; “Invia referto” send TEHR to the patient.

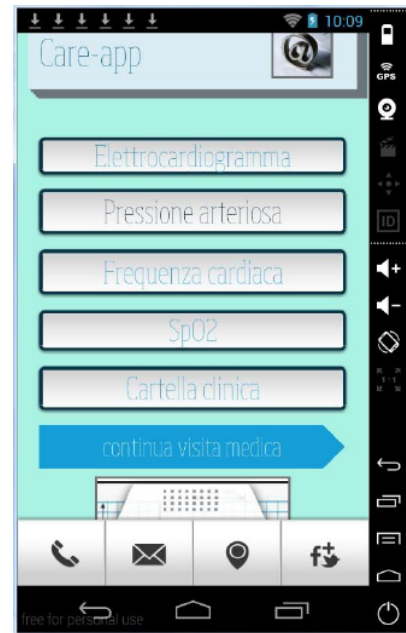


Fig. 8a



Fig. 8b

Figure 8: Menu for doctor continuing the visit. Translate the insets as follows: Figure 8a “Elettrocardiogramma” ECG; “Pressione arteriosa” arterial pressure; “Frequenza cardiac” heart rate; “SpO2” oxygen saturation; “cartella clinica” TEHR; “continua visita medica” continue medical visit. Figure 8b: “Glicemia” blood glucose; “Peso” weight; “Diuresi” diuresis; “Dieta” diet (food); “Attività fisica” physical activity; “Temperatura” body temperature; “Freq. respiratoria” respiratory rate; “Terapia in corso” ongoing therapy.

If the real time is preferred, the doctor has to click onto its own “Elettrocardiogramma”, *i.e.* ECG, button, shown in Figure 8a, and the patient has to click onto the “Start ECG” button, shown in Figure 6. These actions allow starting the app for the acquisition of the ECG on the patient’s device (smartphone/PC) and contemporary allow starting the app named desktop, suitable to view the ECG traces on the doctor’s device.

Desktop is a Facebook plug in allowing the remote view of the desktop of a Facebook friend, powered by RealVNC [21].

If the desktop plug in is not installed on the devices, Care-app automatically requires the installation or, if the installation is denied, it allows switching for another app for desktop remote viewing, like VNC [22] or RDS by Microsoft or LogmeIn [23].

If the doctor likes to view the recorded file, the ECG driver (app) running on the patient’s device provides to record and store the file in a cloud web service accessible to the doctor, or to send it as a Facebook’s message or status attached file.

Something as in Figure 9 is the result of the acquisition of an ECG with 12 derivations.

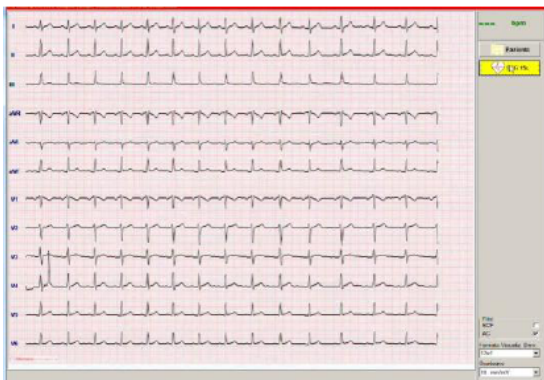


Figure 9: ECG file

The electrocardiograph is a PC-based one, if the patient uses a personal computer. In this case, it is possible to perform an electrocardiogram up to 12 derivations. Moreover, if the patient uses a smart phone, it is possible to perform a single derivation ECG by an electrocardiograph connecting the smart phone wireless or wired, by the microphone/headphone input. See for example the Alive Cor Heart Monitor [24] suitable for smart phones using as iOS as android operating system.

The AliveCor Heart Monitor fits on most mobile devices. It simply rests on your fingers or chest to record an ECG.

AliveCor’s proprietary technology converts electrical impulses from user’s fingertips into ultrasound signals transmitted to the mobile device’s microphone.

This makes the smart phone a real electrocardiograph having a single derivation.

Once the doctor has completed the ECG’s acquisition step, he should once more open the TEHR clicking onto the button “Cartella clinica” shown in Figure 8a. Then, it appears the TEHR form as shown in figure 7b and the doctor can write notes about the performed ECG. The doctor may open the TEHR and write notes whenever he wants because any page of the software Care-app, doctor side, has a button “Cartella clinica” linked to the TEHR utility.

All the other steps of the remote medical visit, as in the menu of Figure 8, follow at the same method described up to now. The driver for all medical instrumentation are web app, local app viewed by desktop remote view app, or phone app.

Examples are in Figures 10a-b respectively for the heart rate and arterial pressure measurements, performed by an iPhone 5S device, in this example.

Once more, the Facebook “share” button allows a quick share of the screenshots with the doctor.

It is possible also to use apps suitable for the arterial pressure measurements and storage, sending the measured values directly in the healthvault file of the patient under visit and in cloud folders.

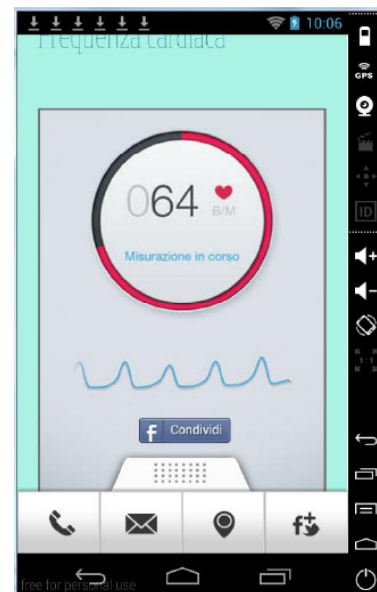


Fig. 10a



Fig. 10b

Figure 10: Screenshot of the heart rate measurement (a) and of the arterial pressure measurement (b) shared by the patient with the doctor by a private message or by a Facebook status with appropriate settings of the privacy options in order to allow only the doctor to see them.

See for example SmartBP tracker [25].

The platform Telemed-care easily includes medical devices and related apps to perform other examinations.

Consider, for example, the app “heart fitness” to perform the measurement of the heart rate and of the blood oxygen saturation [26]. This method has been declared by the developer as tested and validated against FDA-approved instruments in clinical conditions (FDA stands for Food and Drug Administration).

Moreover, it is very useful an app suitable for physical activity monitoring [27] that runs by clicking onto the button “Monitor attività fisica”, *i.e.* physical activity monitoring, of the management software Care-app (Figure 6).

Alternatively, clicking onto the same button it is possible to launch another app very useful to monitor the physical activity [28].

The management software Care-app should launch also the app named runtastic [29] to perform the heart rate measurement. Using this app or others like this (instant heart rate, for example [30]), the camera on the back of your smartphone carries-out the heart rate measurement without adding other medical devices. The patient can share the heart rate value with the doctor via Facebook and/or should send to the doctor

the measurement via e-mail. Care-app easily manages all these sharing and sending options.

As an example, in Figure 11a there is a screenshot relevant to the physical activity monitoring, sent by the patient to the doctor by the Facebook’s share button.

Moreover, the Facebook’s share button used together with a proper app, for example vueme [12], allows the patient sending medical images (x-ray, for example) to the doctor, as shown in Figure 11b.

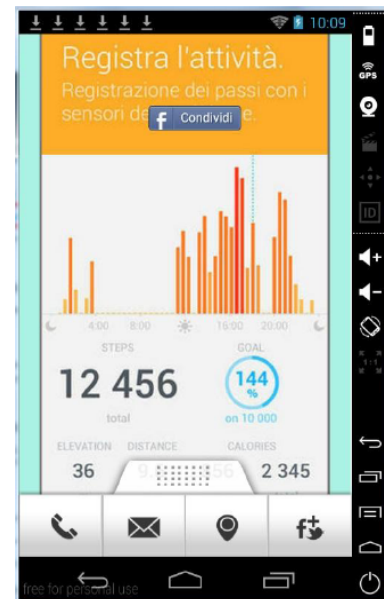


Fig. 11a



Fig. 11b

Figure 11: Screenshots of the physical-activity monitoring app (a) and of the medical image-sending app (b) shared by the patient with the doctor by a private message or by a Facebook share utility, with appropriate settings of the privacy options in order to allow only the doctor to see them.

The patient also may use the Facebook share button or private message button, to send the doctor any other kind of information he may acquire and store with its own side Telemed-care platform.

Always the software Care-app of the Telemed-care platform manages all these steps, apps and operations performed by the doctor and by the patient during the remote medical visit session.

The list of medical examinations included, until now, into the platform Telemed-care, concludes with eye exam, hearing test and sonnigrafia. The doctor should require for these examinations and reports clicking onto the related button, as in Figure 12.

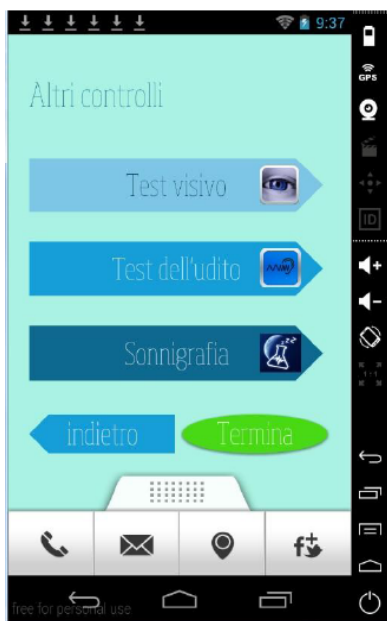


Figure 12: Screenshot of Care-app suitable to perform other final examinations. Translate the insets as follows: “Test visivo” eye exam; “Test dell’udito” hearing exam; “Sonnigrafia” sonnigrafia.

At the end of the medical examinations, the doctor has to update the TEHR and the HEHR files of the patient, as suggested by Care-app, doctor side, whose screenshot is in Figure 13.

The doctor has to send the TEHR to the patient (that is a report of the performed medical visit containing all diagnostic notes, reports and values of the performed medical exams, and suggestions for diagnosis and therapy), clicking onto the “send” button on the TEHR form, as shown in Figure 14a.

Finally, he can click onto the button “End visit” at the bottom of TEHR form, shown in Figure 14b, and then return to its home page.

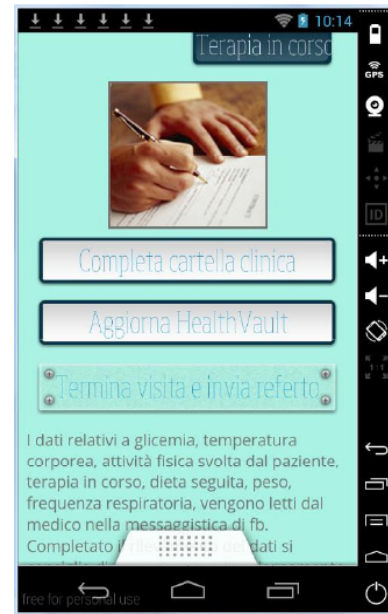


Figure 13: Conclusive options for the doctor. Translate the insets as follows: “Completa cartella clinica” complete/fill the TEHR of the patient; “Aggiorna HealthVault” update the HEHR of the patient; “Termina visita e invia referto” End medical visit and send report to the patient.

It is noticeable that the links provided to apps of third parts are suitable for iOS smartphone and tablets, but the same apps are in google play store for smartphones and tablets using android as operating system. Therefore, Telemed-care is suitable for android and for iOS operating systems.

Moreover, Telemed-care has been planned/ designed in the observance of the current regulations in the order of medical devices and of informatic safety and privacy.



Fig. 14a



Fig. 14b

Figure 14: (a) TEHR field “Diagnosi e terapia”, i.e. “Diagnosis and therapy”, and the “send” button to send to the patient the TEHR. (b) Menu of Care-app, doctor-side, to quit the remote visit or to come back to any previous step.

Translate the insets as follows: “Torna inizio visita” come back to the starting visit step. “Auscultazione” come back to the auscultation step. “Visita cardio” come back to the cardiological examination. “Altri esami” come back to other examinations. “Aggiorna Hvault” as update HEHR; “Menu visita medica” come to the full menu of the medical visit; “Termina visita” end visit.

Care-app also provides the doctor with a “desk” button, as in Figure 1, he can use during any step of the medical visit to see some utilities such as pharmaceutical reference book, the manual physician, physician portal, etc. Clicking onto the “desk” button a screenshot like in Figure 15 appears, providing the doctor with a number of utilities. The doctor can access each utility simply clicking on the corresponding arrow.

It is possible to add quickly and easily any other utility into the software Care-app, as doctor side as patient side.

4. CONCLUSIONS AND FUTURE DEVELOPMENTS

In conclusion, we can maintain with reasonable and proven certainly the Facebook social network and the related apps and web services, embedded in the described Telemmed-care system with its own software Care-app, turns out very useful for telemedicine purposes.

The platform Telemmed-care appears innovative and good quality especially thanks to the real-time remote medical examinations it allows, by using as PC as smartphones.



Figure 15: Screenshot of the “desk” utilities for the doctor (i-library). Translate the insets as: “Prontuario SSN 2014” pharmaceutical reference book 2014; “Manuale Roversi” medical encyclopedia

In fact, Telemmed-care aims at the homecare purposes by using Facebook and other apps and web technologies, and it is suitable as for personal computer as for mobile devices, using as android as iOS operating systems.

In Telemmed-care all the most advanced technologies of biomedical engineering, information and communication converge [31] to guarantee an efficient and reliable home assistance that allows the patient a highly better quality of life in terms of prophylaxis, treatment and reduction of discomfort connected to periodic patient controls and/or hospitalization. Moreover, Telemmed-care allows considerable savings on the sanitary expenses because of the reduction of hospitalization time by home tele-protection, by avoiding the hospitalization of patients in decompensation that are remotely monitored while staying at home.

Finally, by Telemmed-care can be significantly reduced the waiting lists for the most massive control medical examinations, for example to perform the electrocardiogram.

Therefore, the numerous advantages due to the Telemmed-care usage are:

The possibility to carry out a complete cardio-respiratory check-up in real time at home (more complete than a classic generic medical examination)

but also at the chemist's either in other equipped health service centres or at nursing homes;

The reduction in number and of time of hospitalization;

The reduction of the discomforts for patients subject to periodic check-up, above all disabled ones and the breaking down of waiting lists;

The possibility to carry out medical tests also specialized ones frequently and at low cost;

The possibility to carry out mass prophylaxis not only at cardiac level but also at respiratory one.

Moreover, Telemed-care assures a better service to the patients after the discharge from hospital and with their permanence at home or in the long hospitalization facilities or nursing homes in addition to a prompt specialistic attention.

In the end, we have demonstrated designing and using the platform Telemed-care, that smartly using Facebook social network, together with smartphone apps and web apps, could permit a significant saving of the health care expenses and an improvement of the quality of chronic patient's life. In fact it allows offering patients frequent and easy check-up in the privacy of the home and by avoiding expensive hospitalization.

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