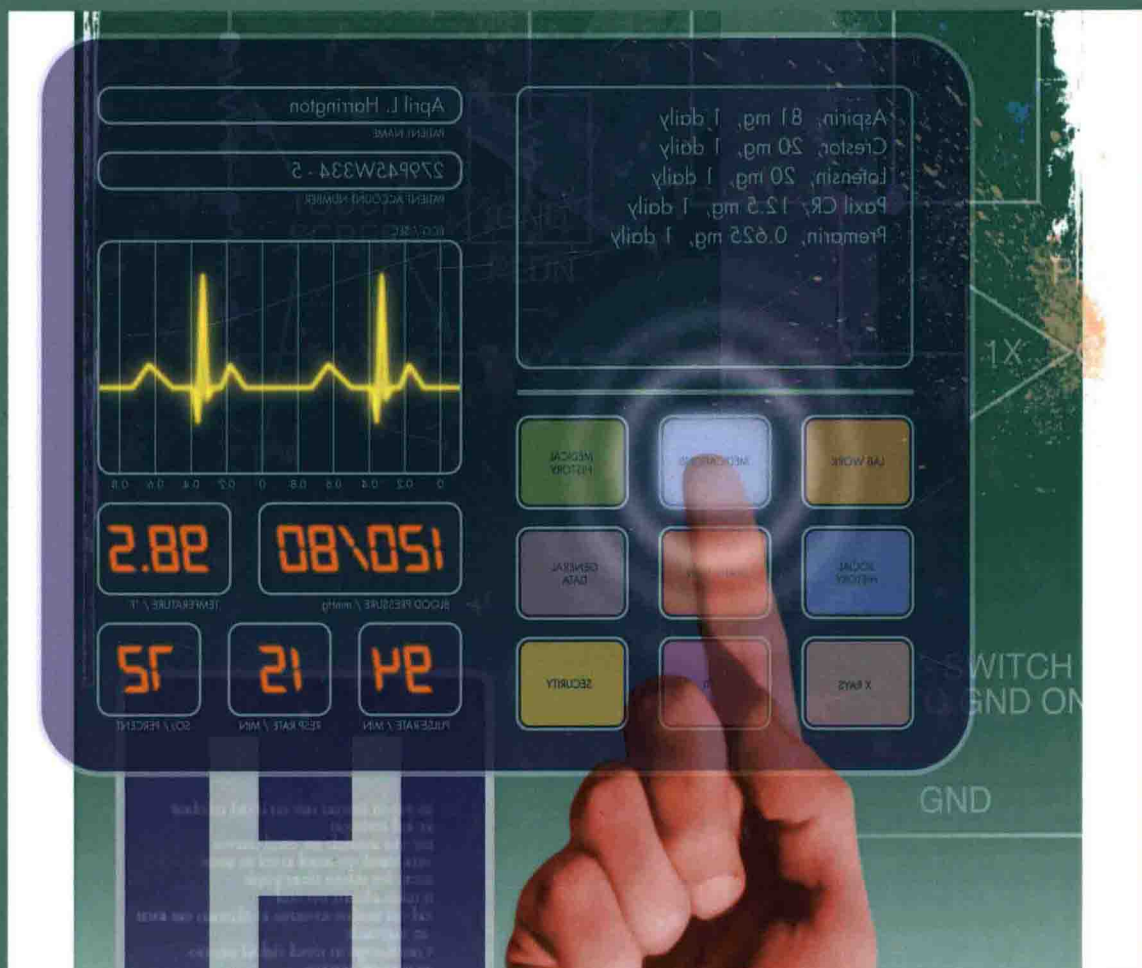


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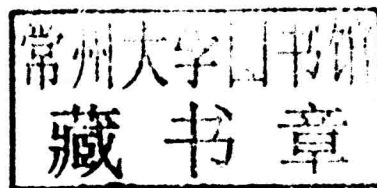


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Digital Advances in Medicine, E-Health, and Communication Technologies

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Preface

The book “Digital Advances in Medicine, E-Health, and Communication Technologies” is the second publication of Advances in E-Health and Medicine series created to disseminate recent advances in electronic health (e-health), medical communications, and services and applications for e-health and medicine. This series compiles and reprint the strong contributions published by the *International Journal of E-Health and Medical Communications* (IJEHMC) (<http://www.igi-global.com/IJEHMC>), IGI Global, USA, ISSN: 1947-315X, EISSN: 1947-3168. With the success of this journal publication, the book reprints the articles published in 2011. Along its twenty-one chapters, theories, systems, methods, algorithms, and applications in health, healthcare, biomedicine, telemedicine, and medical communications are presented, furnishing important contributions to the state of the art and offering, at the same time, an important updated overview about emerging communication technologies for e-health and medicine. These topics are very updated and extremely important for the community both from industry and academia. Authors around the world, also both from industry and academia, shared their contributions to offer a composition that is very useful for readers.

The book starts with a chapter addressing *A Comprehensive Overview of Wireless Body Area Networks (WBAN)*, by Nourchene Bradai, Lamia Chaari, and Lotfi Kamou, from Sfax University, Tunisia. In recent years, the wireless body area network (WBAN) has emerged as a new technology for e-healthcare applications. The WBANs promise to revolutionize health monitoring. However, this technology remains in the first stages and much research is underway. Designers of such systems face a number of challenging tasks, as they need to address conflicting requirements. This includes managing the network, the data, while maximizing the autonomy of each network node. Reducing the consumption of a node, the management of network resources and security insurance are therefore major challenges. This chapter presents a survey of body area networks including the WBANs challenges and architecture, the most important body sensor devices, as well as sensor board hardware and platforms. Further, various applications of WBANs in the medical field are discussed, as well as wireless communications standards and technologies. The newest researches related to WBANs at physical and MAC layers are presented. Finally the chapter identifies data security and privacy in WBANs as well as open research issues. It includes flexibility, fault tolerance, high sensing capabilities, low cost, and quick installation, characteristics that enabled sensor networks to have new areas of applications and multiple stimuli.

In the second chapter, *An Advanced and Secure Symbian-Based Mobile Approach for Body Sensor Networks Interaction*, by Orlando Pereira, João M. L. P. Caldeira, and Joel J. P. C. Rodrigues, proposes a solution where the combination of body sensor networks (BSNs) and mobile devices brings a personalized health monitoring opportunity to patients and medical teams. Mobile devices may be used to process and present data collected by BSN sensors in an easy and meaningful way to users. The mobility of such

systems improves patients' quality of life, enabling continuous unobtrusive health monitoring during regular daily routine tasks. This chapter presents a Symbian-powered smartphone based solution for BSN sensors data gathering, monitoring, and presentation. The systems' sensor platform hardware provides an onboard long-term data storage module, enabling continuous data gathering even in the absence of the mobile device. The mobile device connects wirelessly to the BSN using Bluetooth technology, supporting interaction with multiple sinks. This system aims to help patients that need continuous monitoring of human bio-physiological parameters in a transparent and unobtrusive way. A case study is presented, based on a sensor for women's core body temperature collection, enabling fertility follow up processing. The system was evaluated successfully, proving its usefulness in a real scenario. As a result, it is ready for regular use. These authors, from the *Instituto de Telecomunicações*, Portugal, and the University of Beira Interior, Covilhã, Portugal, also extended this proposal for other mobile operating systems, such as Android, iPhone, and Windows.

The third chapter, *Pervasive Computing Support in the Transition towards Personalised Health Systems*, discusses pervasive computing work in the transition from traditional health care programs to personalized health systems (pHealth). A chronological guided transition survey is discussed to highlight trends in medicine describing their most recent developments about health care systems. This model comply with the requirement of immerse devices in daily patients activities with not necessary to change life activity to be attended, receive medical assistance and or simply health patterns monitoring. Patients are only requested to be at hospitals or specialized medical centres when it is absolutely necessary, as result of measures informed constantly. Future trends in this interdisciplinary techno-medical area are described as research goals. Particularly, research and technological efforts concerning ICT's and pervasive computing in healthcare and medical applications are presented to identify systems requirements supporting secure and reliable networks and services. The main objectives are to summarize both the pHealth systems requirements providing end-user applications and the necessary pervasive computing support to interconnect device-based health care applications and distributed information data systems in secure and reliable forms, highlighting the role pervasive computing plays in this process. A generic personalised healthcare scheme is introduced to provide guidance in the transition and can be used for multiple medical and health applications. The proposed pHealth scheme design involves end user participatory model where the pro-activeness of patients is considered more seriously than ever before. In this approach technology advances in end user's devices promoting dynamic patient participation does not represent a technological limitation anymore. These and many other examples are just some of the first instances of people's tendency to acquire a self-management healthcare culture. This chapter introduced the authors' vision for cluster computing supporting personalised health systems, particularly addressing privacy. As an illustrative example of this approach, secure heart rate monitoring of signals (ECGs) has been briefly discussed. Research efforts have been conducted to promote cluster algorithms as an alternate privacy solution for finding out data similarities between particular cardio-vascular pattern and cardio-vascular patterns from patients with problems previously diagnosed/detected. Martín Serrano, Ahmed Elmisery, Mícheál Ó Foghlú, Willie Donnelly are with Waterford Institute of Technology, Ireland, and Cristiano Storni and Mikael Fernström are with University of Limerick, Ireland.

In the fourth chapter, *Study of Zero Velocity Update for Both Low- and High-Speed Human Activities*, by R. Zhang, M. Loschonsky, and L. M. Reindl, presents a novel Zero Velocity Update (ZUPT) system which can be used in a wide range of human activities, including walking, running, and stair climbing by using two inertial measurement unit (IMU) modules. One is attached on the centre of the human body for human activities' classification and recognition. The other one is mounted on the foot

for ZUPT algorithm implementation based on the result of activities' recognition. In this way, proper ZUPT thresholds can be determined by classifying and recognizing different movements through the function mode. Previous studies show that inertial sensor-based personal positioning benefited from Zero Velocity Update (ZUPT) method by resetting the foot speed at every foot step. However, only the solution for normal pedestrian movement with small velocity like walking was given. Test cases include stair climbing by walking and running, walking, fast walking, and running. In all cases, most of the steps are able to be detected and the new ZUPT system can be successfully implemented. However, all the experiments were operated by human being, and the speed of different movements could not be precisely controlled and kept as constant, therefore, it was impossible to find the relationship between classification factor and ZUPT threshold of each point on the speed axis and process point-by-point function construction. As a result, there might be some uncertain points in the transition function model affecting the ZUPT threshold determination. Further study of the relationship between the classification factor and ZUPT threshold may need a pedestrian robot providing constant acceleration and moving speed. Besides, how to further enlarge the usage range of ZUPT for non-foot related movement like normal climbing, forward and backward roll needs to be investigated in future. The authors are with University of Freiburg, Germany.

In the fifth chapter, *Applications of Policy Based Agents in Wireless Body Sensor Mesh Networks for Patient Health Monitoring*, Kevin Miller and Suresh Sankaranarayanan uses an intelligent agent based hierarchical architecture presented in the authors' previous work for health monitoring. They proposed a technique of monitoring and notifying the patients health using an intelligent agent to the concerned hospital personnel. Considerable research interest in using wireless and mobile technologies in patient health monitoring exists, particularly in hospitals and nursing homes. This chapter presents the details of the functioning of four main intelligent agents, i.e., the nurse agent, the sensor agent, the database agent, and the ward boy agent, for intimating the health information to the concerned doctor in the hospital, based on certain policies relevant to the hospital. The policies worked based on the temperature parameter monitored by the nurse agent. The chapter considers an example of the physiological parameter i.e., the body temperature monitoring, for policy based agent implementation. The implementation was carried out using JADE-LEAP agent development kit. The work done can be extended further by monitoring multiple physiological parameters like pulse rate, blood sugar level, etc., and making appropriate decisions for intimating doctors. In this case, the responsibilities of agents would increase, and thus more intelligent processing would have to be incorporated while still being aware of the processing limitations of sensor devices. This work can also be further extended to not only monitor patients in hospitals but to incorporate the monitoring of out-patients at home and aged care. In addition, security is an important aspect of wireless communication, hence, the analysis of the security aspects is inevitable. Finally, since authors are dealing with a time critical service, there has to be some formal guarantee about the quality of service of the architecture. Therefore, it is imperative that in future work, that quality of service technologies be deployed. The authors are with University of West Indies, Jamaica.

The sixth chapter, *Acquisition of Multiple Physiological Parameters During Physical Exercise*, describes the experimental method focused on the acquisition of various physiological parameters during different effort levels of physical exercise like walking and running at several velocities. The ultimate goal of this research was the use of easily collected physiological data to assess the energy expenditure of a healthy subject. The validation of the estimated model was achieved by comparison with the considered "gold standard" of respiration gases analysis. Yet, the tasks that were involved in the obtention of the data are per se worthy of description and may serve as guidelines to future research in this area.

The study involved 57 young and adult people, 43 male and 14 female ($24,37 \pm 5,96$ years), from which 48 were soldiers belonging to the Infantry Regiment n.º 13 (RI13) of the Portuguese Army and 9 were teachers or college students of Sport Sciences, physically active but not competitive. The experimental measures provide a set of information that offers insight about the health status and physical performance of the subjects during exercise. This experimental method procedure is suited for the acquisition of physiological parameters with both the wireless physiological data acquisition systems such as the bioPlux and the respiratory analyzer gas systems such as Cosmed K4b2. The data was collected to allow the definition of a model that will be used to estimate the energy expenditure of a subject using a wireless physiological data acquisition system, which is much more comfortable and suitable to monitor physical exercise in everyday use than the standard method that makes use of a respiratory gas analysis system. This research showed that the used methodology is adequate for the collection and recording of the number and variety of physiological parameters. The fact that this methodology has tapped the potential of bioPlux for the acquisition of multiple physiological parameters and the collaboration of the military subjects contributed to add value to the recorded data, thus enabling and valuing the availability of data for those who want to further research on it. Also, the large number of variables obtained during exercise allows carrying out work in areas such as monitoring the health condition, athletic performance, and energy expenditure analysis across gender, among other studies. However, the methodology has limitations related to the experimental sample and exercise plan. The experimental sample can limit the study scope because it is composed by youth and adults with habits of daily physical activity, which is not representative of the general population. Nevertheless, considering an active and homogeneous sample has relevance in this type of study. Furthermore, the plan does not include exercise at slow speeds and levels of sedentary activity as the physical activity performed was classified as moderate, vigorous and very vigorous. So the further research is needed to collect and record data for light and sedentary activities. As two acquisition devices were used, being one of them a “gold standard” for the estimation of energy expenditure, the Cosmed K4b2, it was possible to validate the xyzPlux accelerometer for the energy expenditure estimation. Moreover, the acquisition system bioPlux is shown to be applicable for a wide number of scenarios, in particular in studies involving physical activity or free living, due to its portability, lightweight and wireless communication capabilities. Virginie Felizardo and Pedro Dinis Gaspar are with University of Beira Interior, Portugal, Nuno M. Garcia with Lusophone University of Humanities and Technologies (ULHT), Portugal, and Victor Reis with University of Trás-os-Montes and Alto Douro, Portugal.

In the seventh chapter, Lamia Chaari and Lotfi Kamoun, Sfax University, Tunisia, focuses on *QoS Concepts and Architecture Over Wireless Body Area Networks for Healthcare Applications*. Wireless Body Area Networks (WBANs) applications have emerged as one of the most recent research areas of wireless sensor networks. Lots of research is improving quality of service (QoS) factors in sensor networks. However, QoS requirements vary from application to application, WBAN applications are very sensitive, and QoS issues in WBAN need major concern and focus. This chapter outlines the WBANs QoS requirements and factors and reviews with emphasis on their strengths some medium access (MAC) mechanisms that response to some QoS challenges. Moreover, the authors have defined and specified a QWBAN MAC protocol that can allow the integration of QoS architecture over WBAN. A set of QoS modules such as admission control (CAC), band- width allocation and scheduling are discussed. Besides that, an integrated QoS architecture is suggested for WBAN to support healthcare applications.

The eighth chapter, *Improving Supervised Classification of Activities of Daily Living Using Prior Knowledge*, is proposed by Anthony Fleury, University Lille Nord de France, France, by Norbert Noury,

University of Lyon, France, and by Michel Vacher, LIG Laboratory, France. Authors present the results of the study of prior introduction, in Support Vector Machine, to improve the automatic recognition of Activities of Daily Living. From a set of activities, performed in the experimental smart home in Grenoble, the authors obtained models for seven activities of Daily Living and tested the performances of this classification with introduction of spatial and temporal priors. Eventually, different results are discussed. This work offers the opportunity to evaluate the effect of considering priors in a supervised classification process for activities of daily living. Such process can be used for two different applications. The first is for assistance of the person in an Ambient Assisted Living environment. Knowing the activity currently performed, the person can be assisted in this activity or check some specific states (for example that she turned off the gas in case of cooking). Moreover, the sound and speech recognition system of the flat could also be used as a way to improve the home automation system. The second application is for the long-term monitoring of a person at home. During this monitoring process, the important is to know whether the set of vital activities were performed during the day (eating, going to the toilets, self care...) and to evaluate the level of performance of each activity.

The ninth chapter, *Development of Audio Sensing technology for Ambient Assisted Living: Applications and Challenges*, presents the issues in this domain based on three experiments conducted in a health smart home involving the audio processing software AuditHIS. The 2 first experiments were related to distress detection from speech. Most of the encountered problems were due to noise or environmental perturbation. The third experiment was related to the audio analysis of usual daily activities performed by fifteen healthy volunteers. The dataset was recorded in realistic conditions and underlines the main challenges that audio analysis must address in the context of ambient assisted living. Among the most problematic issues were the uncontrolled recording condition, the mixing of audio events, the high variety of different sounds and the complexity to discriminate them. Regarding the latter, authors plan to conduct several studies to determine what the most interesting features for sound classification are as well as how hierarchical modeling can improve the classification. Moreover, regarding speech recognition, probabilistic models need to be adapted to the ageing population. They are currently recording seniors' voice to adapt our ASR to this population. Finally, an audio technology needs to be improved to be efficient in health related application. The nationally financed Sweet-Home project, which focuses on home automation through voice orders, will permit additional study on speech recognition in smart homes. Keyword recognition and signal enhancement through Independent Component Analysis methods are part of this project. Michel Vacher and François Portet are with Laboratoire d'Informatique de Grenoble, UMR CNRS/UJF/G-INP 5217, France, Anthony Fleury is with University Lille Nord de France, France, and Norbert Noury with University of Lyon, France.

The tenth chapter, *On the Use of Home Node Bs for Emergency Telemedicine Applications in Various Indoor Environments*, elaborates about the use of emergency telemedicine applications at the site of a medical emergency event providing a multitude of benefits, both from the perspective of the patient and the emergency care providers. Innovations in rich multimedia telemedicine solutions further enhances the aforementioned benefits, but places more stringent quality-of-service demands on the underlying mobile networks. In this chapter, the authors present a proposal for a complementary solution for rapid provisioning of mobile broadband data connectivity for emergency telemedicine applications in indoor environments. The proposed solution relies on the exploitation of existing femtocellular network resources available at emergency sites in various residential building types. Simulations carried out for a UMTS network environment demonstrate significant improvements in terms of achievable throughput for the emergency mobile terminal device when access to UMTS Home Node Bs available in the building is

allowed for emergencies compared to macro Node B access only. In the future authors intend to extend the MNB and HNB emergency access study to consider the evolved radio access technology, specifically Home eNode Bs for use in Long Term Evolution (LTE) networks. Furthermore, they will revise the study to quantify the performance benefits of various interference mitigation techniques (e.g., beamforming, scheduling, etc.) in co-channel macro- and femtocellular network environments. Edward Mutafulungwa, Zhong Zheng, Jyri Hämäläinen, Mika Husso, and Timo Korhonen are with Aalto University School of Science and Technology, Finland.

The eleventh chapter, *Modeling Emergency and Telemedicine Health Support System: A Service Oriented Architecture Approach Using Cloud Computing*, Weider D. Yu and Radhika Bhagwat, examines the study of healthcare services provided through a telemedicine oriented Emergency Health Support System (EHSS). This study caters to the needs of senior citizens, but can be extended to a larger population. The main goals are to model the support system in Service Oriented Architecture (SOA) using Cloud Computing and study its performance. The chapter compares a system deployed in the cloud versus a co-located environment based on data gathered from the prototype. The emergency support system has a 24/7 remote healthcare monitoring of registered users and provides immediate support in case of a healthcare emergency. The telemedicine system empowers the physicians to prescribe medication based on the users' vitals, via email, instant messaging, or phone. The system can be based on the platform of Cloud Computing to not only improve performance, but also cut down on computing and networking resource requirements to a large extent. A prototype of Emergency Health Support System has been developed and the system has been modeled and tested to derive performance statistics of the system's capability. The authors are with San Jose State University, USA.

The twelfth chapter *Discrete Portable Measuring Device for Monitoring Noninvasive Intraocular Pressure with a Nano-Structured Sensing Contact Lens Prototype* proposes a new portable measuring device for monitoring intraocular pressure with a non invasive system using a prototype of contact lens has been developed. The contact lens is based on a new organic flexible highly piezo-resistive film sensor that is glued to the central hole of a lens. The measuring system is wire connected to the contact lens and incorporates user interface methods and a Bluetooth link for bi-directional wireless data transfer. The key design aspects of such architecture are discussed in this chapter. The system is designed with an architecture that can be integrated in the future in order to be placed in the contact lens. The discrete system is used to validate the electronic measurement operation and the contact lens sensor (CLS). The measurement instrument can calibrate the differences of the nominal value of the sensor and measure resistances variations that are related to pressure variations. The measuring system and the contact lens sensor were tested with an eye phantom and with enucleated pig eyes by applying pressure changes between 7 to 32 mmHg recording the electrical changes with the portable device. This chapter is authored by Ana Moya and Antón Guimerà, CIBER-BBN and IMB-CNM (CSIC), Spain, Irene Sánchez, CIBER-BBN and University of Valladolid, Spain, Vladimir Laukin, ICREA and CSIC, Spain, Raúl Martín, CIBER-BBN and University of Valladolid, Spain, Fernando Ussa, University of Valladolid, Spain, Elena Laukhina, Concepció Rovira, and Jaume Veciana, CIBER-BBN and CSIC, Spain, José-Carlos Pastor, University of Valladolid, Spain, and Rosa Villa and Jordi Aguiló, CIBER-BBN and IMB-CNM (CSIC), Spain.

The thirteenth chapter, *A Prototype Agent Based Model and Machine Learning Hybrid System for Healthcare Decision Support*, by Marek Laskowski, University of Manitoba, Canada, presents a vertical slice of a decision support tool for healthcare policy, featuring Agent Based Modeling and simulation with a GP-based ML system. It demonstrates that this ABM-ML system is capable of performing basic

automated hypothesis generation within a healthcare policy context. The contribution of this work includes the development of the ABM framework amenable to ML, and subsequent ABM-GP integration. Preliminary results validate the approach used, adding credibility to the statement that Machine Learning will be more routinely coupled with ABMs in the near future. By corollary, the actual evaluation and/or statistical comparison of GP-evolved ED policy remains beyond the scope of this work, however the foundations for this are clearly laid. The policy learning task, as defined herein, is a difficult and unprecedented ML task, presenting challenges in terms of compute resources, as well as a first foray into machine augmented or directed decision support with respect to patient care, and healthcare in general. At least one of the evolved policies was a counter-intuitive or unexpected result. Such policies are an example of the inventive capabilities of GP, and may open up otherwise unexplored possible policy interventions to healthcare practitioners. Future improvements are expected with the increased availability of compute resources, as well as enabling the evolution of separate policies for the specialized agent roles. This work brings socio-ethical issues to the forefront, as it marks the first time that a machine evolved healthcare policy could conceivably be implemented in a real ED. If evolved policies are implemented in an actual ED, who is responsible when patients care or outcomes are compromised in the care of the ED? This question is applicable to any deployed AI system capable of learning and with the consequences of failure impacting the welfare of human beings. Issues such as these need to be more fully explored given the suggestion that industrialized countries with aging populations may face increasing amounts of machine-directed care by automated processes or robots.

In the fourteenth chapter, *Proposed Framework for the Deployment of Telemedicine Centers in Rural Bangladesh*, by Raqibul Mostafa, Gazi Mehedi Hasan, A. M. Alomgir Kabir, and Md Atiqur Rahman, proposes a comprehensive framework for the deployment of effective telemedicine centers in diverse locations in Bangladesh. The framework employs a top-down analysis and design approach by properly organizing the key elements comprising it. The elements include a nationwide analysis of demographics along with current healthcare scenario as well location-specific pre-deployment studies and the recommended telemedicine solution. This framework will be a valuable guide to deploy effective and long-term telemedicine center at any given location. Towards this goal, the chapter presents the framework along with a detailed discussion of the constituent elements, and analyzes several case studies to demonstrate the application of the framework to provide site-specific telemedicine solutions at some selected test sites. All the previous telemedicine projects in Bangladesh suffered from a lack of sustainability and it is expected that deployments based on the proposed framework will be effective, scalable, and long-lasting in bringing e-healthcare to the target population in Bangladesh. The authors are with United International University, Bangladesh.

The fifteenth chapter, *Affordable System for Rapid Detection and Mitigation of Emerging Diseases*, is authored by Nuwan Waidyanatha, LIRNEasia, China, Artur Dubrawski, Carnegie Mellon University, USA, Ganesan M., IITM's Rural Technology and Business Incubator, India, and Gordon Gow, University of Alberta, Canada. The authors reflect about several emerging diseases. For example, South and South-East Asian countries are currently in the midst of a new epidemic of Dengue Fever. The chapter presents disease surveillance systems in Sri Lanka and India, monitoring a handful of communicable diseases termed as notifiable. These systems typically require 15-30 days to communicate field data to the central Epidemiology Units, to be then manually processed. Currently used analyses rely on aggregating counts of notifiable disease cases by district, disease, and week. The Real-Time Biosurveillance Program (RTBP), a multi-partner initiative, aims at addressing those challenges by developing affordable paradigm-changing Information Communication Technology (ICT), implementing and field- testing them in India and Sri

Lanka. Key components of the proposed solution include real-time digitization of clinical information at hospitals and clinics with the mHealthSurvey mobile phone software, detecting anomalies in large multivariate biosurveillance data using the T-Cube Web Interface spatio-temporal statistical analysis tool and disseminating critical information pertaining to the adverse events to healthcare workers using the Sahana Alerting Module. This chapter also provides an overview of the applications and discusses utility of the technologies for real-time detection and mitigation of emerging threats to public health.

In the sixteenth chapter, *Malaria Parasite Detection: Automated Method Using Microscope Color Image*, Anant R. Koppar and Venugopalachar Sridhar focus on Healthcare Delivery Systems, solutions that are becoming overloaded in developing countries like India and China. It is imperative that more efficient and cost effective processes are employed. One such requirement is the automatic detection of malaria parasites in stained blood smears. Malaria is a mosquito-borne infectious disease. Each year Malaria kills between one and three million people. The most conventional and gold standard test for the confirmation of the Malarial diagnosis is the peripheral blood smear examination. This chapter investigates and develops an automated malaria diagnostic system based on the color image processing using Hue, Saturation & Intensity (HSI) model. The algorithm is designed to identify only parasites inside red blood cells (erythrocytes) to avoid false positive results. The work-flow process has enabled practical tele-pathology by allowing e-collaboration between lesser skilled technicians in rural areas and experts in urban areas, cutting down the total turnaround time for diagnosing malaria from days to minutes. This automated system reduces fatigue by providing images on the screen and avoiding visual inspection of microscopic images. The system has a high degree of accuracy, specificity and better speed in detecting and analyzing the parasites. This achieves the goal of assisting the healthcare professionals as a screening tool rather than replacing them. Hence, it acts as a very cost effective and simple to use system that can be deployed in rural areas and in smaller clinics. The method uses simple, inexpensive hardware and software to achieve these results making it suitable for use in rural / remote areas especially in the emerging economies. The algorithm is designed to identify only parasites inside red blood cells (erythrocytes) to avoid false positive results. Further research needs to be carried out to identify parasites at the periphery of the RBCs. Also further work is being carried out to identify different species and stages of the malaria parasite. There are four different species of Malaria Parasite, which infect human beings namely Plasmodium Falciparum, Plasmodium Vivax, Plasmodium Ovale and Plasmodium Malariae. Each of these parasites is found in the blood in the following four stages - Ring Stage, Trophozoites, Schizonts and Gametocytes. Each of these species and stages can be identified by further feature extraction like texture features and developing a knowledge base to store the feature values as standard templates. The data in the knowledge base can be used to obtain accurate results. As the medication depends on the identification of the stage and type of infection, this research is critical. Anant R. Koppar is with PES Research Center, India and Venugopalachar Sridhar with P. E. S. College of Engineering, India.

The seventeenth chapter, *A Tool for Automatic Hammersmith Infant Neurological Examination*, presents the design of a semi-automatic application that can be used as an aid to doctors for efficiently conducting the examinations listed in the Hammersmith chart. Hammersmith Infant Neurological Examination (HINE) is a popular method to estimate the neurological development of infants aged less than two years. Using HINE, especially for preterm or premature babies, the risk of neural disorder can be minimized through proper preventive measures. The user friendly version of the examination interface provides a platform for quantitative neurological assessment of the infants. It includes various simplified video and image based schemes that are suited to inexperienced staff. It provides an interface

to go through the previous records of patients. Ten examinations are enlisted in the Hammersmith chart for neonatal babies. This chapter examines a semi-automatic approach for posture estimation examination. For post neonatal infants, a follow-up management interface is designed that can be used to fetch / consult past records of the patients for better diagnosis. Nevertheless, application of computer vision in conducting HINE is a challenging problem but can increase the efficacy of the examination process. Authors have found that the preterm infants are likely to go through neurological disorder during later phases of life. An early detection of such disorder is helpful in diagnosing neurological abnormalities. The application is currently in operation at Neonatal Intensive Care Unit (NICU) of Institute of Post-Graduate Medical Education & Research (IPGME & R) and Seth Sukhlal Karnani Memorial (SSKM) Hospital, Kolkata, India. Debi Prosad Dogra, Karthik Nandam, Arun Kumar Majumdar, Shamik Sural, Jayanta Mukhopadhyay, and Bandana Majumdar are with Indian Institute of Technology Kharagpur, India, and Arun Singh and Suchandra Mukherjee with Institute of Post Graduate Medical Education & Research, S.S.K.M. Hospital, India.

In the eighteenth chapter, *Evaluating the IEEE 802.15.6 2.4GHz WBAN Proposal on Medical Multi-Parameter Monitoring under WiFi/Bluetooth Interference*, Yufei Wang and Qixin Wang, The Hong Kong Polytechnic University, Hong Kong, evaluate the IEEE 802.15.6 2.4GHz WBAN under WiFi/Bluetooth interference in the context of medical multi-parameter monitoring. It is an important issue because wireless body area networks (WBAN) play a key role in the future of e-Health. In response, IEEE sets up working group 802.15.6 to standardize WBAN schemes. Of all existing standard proposals, the 2.4GHz proposal is the most mature and ready for mass production. However, as e-Health WBAN applications are often mission/life critical, people are concerned with the reliability (particularly, coexistence reliability) of this proposal. The used evaluation metrics are mainly PER and MTTF. To get an accurate evaluation of PER, the authors inspect each segment of a typical IEEE 802.15.6 2.4GHz WBAN packet, taking into consideration of BER, BCH coding rate, repetition times etc. The BER under WiFi interference is obtained through closed form analysis, while the BER under Bluetooth interference is obtained through combined close form analysis and simulation. Once have the accurate PER values, they apply them to the multi-parameter monitoring scenario, a representative medical WBAN application that requires high communications/networking QoS, to produce the MTTF curves. The MTTF curves show us that WiFi is a major threat to IEEE 802.15.6 2.4GHz WBAN, while Bluetooth is not. Then, the authors conclude that WiFi poses a major threat to such application scenario, while Bluetooth does not.

The nineteenth chapter, *Expected Communications Technology to Track Avian Influenza and Related the Statement of Appeal by ITU-D SG2 Q14*, points out some problems of telemetry for wild birds and future technical expectations to prevent Avian Influenza. For medium to large migratory birds, the data collection system aboard the NOAA meteorological satellites (the ARGOS system) has been able to map their migratory routes. However, recommended C/No for Doppler shift will be 54dBHz, while calculated required C/No for 400 bps data uplink is 36dBHz. The gap between navigation function and data communication will be almost 18 dB. The bird has to pay this overload. The authors provide a summary of the Statement that was adopted at the Rapporteurs meeting of the ITU-D SG2 Q14 (telecommunications for eHealth) in July 2008 and an account of anticipated developments in telecommunication technologies (satellite and RFID) based on meeting discussions, and strongly recommend the space agency to consider the importance of the advanced data collection satellite to track small birds. Isao Nakajima and Toshihiko Kitano are with Tokai University School of Medicine, Japan, Masaaki Katayama is with Nagoya University, Japan, and Leonid Androuchko with International University in Geneva, Switzerland.

In the twentieth chapter, *Design Considerations for Delivering E-Learning to Surgical Trainees*, Jane Coughlan and Willem-Paul Brinkman addresses an important issue related with continuous medical education/professional development e-health technologies. This study examines the interface design and learning process features related to the use of multimedia in providing effective support for the knowledge and practice of surgical skills. Twenty-one surgical trainees evaluated surgical content on a CD-ROM format based on 14 interface design and 11 learning process features using a questionnaire adapted from an established tool created to assess educational multimedia. Significant Spearman's correlations were found for seven of the 14 interface design features – navigation, learning demands, videos, media integration, level of material, information presentation and overall functionality, and explaining ratings of the learning process. The interplay of interface design and learning process features of educational multimedia highlight key design considerations in e-learning. An understanding of these features is relevant to the delivery of surgical training, reflecting the current state of the art in transferring static CD-ROM content to the dynamic web or creating CD/web hybrid models of education. Jane Coughlan is with Brunel University, UK and Willem-Paul Brinkman is with Delft University of Technology, The Netherlands

Finally, in the last chapter, but not the least, Christopher Hood, University of Oxford, United Kingdom, and Sarah Bougourd, Nuffield Council on Bioethics, United Kingdom presents a research essay on *The Ethics of E-Health*. Online health information, online personal health records, and telemedicine all have an important part to play in the future of healthcare management. All of these developments lend themselves to the provision of healthcare as a consumer good. We think choice is often a good thing, but to work effectively in healthcare it needs to be accompanied by proper information and advice. The developments considered in this chapter can lead to new obligations and expectations for the individuals who use them. For example, commercial online health records systems can place new demands on individuals to check their records and ensure their security. Authors think responsibility for handling new risks associated with these developments should be placed in the hands of those best placed to manage it. In some cases this is the state, in some cases the medical professional, and in other cases the individual. Each case needs to be considered on its own merits. As these technologies develop and become more integrated into people's daily lives, they could transform medical practice in important ways. Authors expect that the recommendations made in this report will be taken on by policy makers and providers of e-health services to enable people to make use of these technologies safely and effectively, and feel supported in identifying the information they need to make good healthcare choices.

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