PROCEEDINGS

of the Union of Scientists - Ruse

Book 5

Mathematics, Informatics and Physics

Volume 10, 2013

RUSE

The Ruse Branch of the Union of Scientists in Bulgaria was founded in 1956. Its first Chairman was Prof. Stoyan Petrov. He was followed by Prof. Trifon Georgiev, Prof. Kolyo Vasilev, Prof. Georgi Popov, Prof. Mityo Kanev, Assoc. Prof. Boris Borisov, Prof. Emil Marinov, Prof. Hristo Beloev. The individual members number nearly 300 recognized scientists from Ruse, organized in 13 scientific sections. There are several collective members too – organizations and companies from Ruse, known for their success in the field of science and higher education, or their applied research activities. The activities of the Union of Scientists – Ruse are numerous: scientific, educational and other humanitarian events directly related to hot issues in the development of Ruse region, including its infrastructure, environment, history and future development; commitment to the development of the scientific organizations in Ruse, the professional development and growth of the scientists and the protection of their individual rights.

The Union of Scientists – Ruse (US – Ruse) organizes publishing of scientific and popular informative literature, and since 1998 – the "Proceedings of the Union of Scientists- Ruse".

BOOK 5

"MATHEMATICS, INFORMATICS AND PHYSICS"

VOLUME 10

CONTENTS

Mathematics

Tsetska Rashkova 7
Identities of $M_2(E)$ are identities for classes of subalgebras of $M_n(E)$ as well

Antoaneta Mihova 14
Polynomial identities of the 3x3 matrices over the finite dimensional Grassmann algebra

Eli Kalcheva 19
On the existence of multiple periodic solutions of fourth - order semilinear differential equations

Veselina Evtimova 27
Some studies on the possibilities to provide emergency medical aid centres with new transport vehicles

Iliyana Raeva 34
System for modeling of ambiguous semantics

Informatics

Valentina Voinohovska, Svetlozar Tsankov, Rumen Rusev 39
Use of computer games as an educational tool

Valentina Voinohovska, Svetlozar Tsankov, Rumen Rusev 44
Educational computer games for different types of learning

Victoria Rashkova, Metodi Dimitrov 49
Creating an E-Textbook for the Course Workshop on Computer Networks and Communication

Metodi Dimitrov, Victoria Rashkova 56
Possibilities of online freelance platforms

Galina Atanasova 60
Didactic aims and perspectives in computer science teaching

Rumen Rusev 66
Software system for processing medical diagnostic images

ValentinVelikov 72
Automatic program generation without internal machine representation

Valentin Velikov 78
System for automated software development

Physics

Lyubomir Lazov, Nikolay Angelov 89
Investigation of the influence of the type of surface on the quality of laser marking

Nikolay Angelov, Tsanko Karadzhov 96
Optimization of the process of laser marking of metal product

Nikolay Angelov, Ivan Barzev 102
Determination of preliminary intervals of the speed of laser welding on electrical steel

Conference ITE - 2012

Tsetska Rashkova 107
Usage of the system *Mathematica* in teaching and learning number theory

Veselina Evtimova 115
Using the Maple software product in studying functions

Ralitsa Vasileva-Ivanova 124
Plane in space with mathematical software

Mihail Kirilov 130
Use of dynamic software for sketches in Geometry lessons

Magdalena Metodieva Petkova 136
GeoGebra in school course in geometry

Milena Kostova, Ivan Georgiev 145
Application of MatLab software for digital image processing

BOOK 5

"MATHEMATICS, INFORMATICS AND PHYSICS"

VOLUME 10

This is the jubilee 10-th volume of book 5 Mathematics, Informatics and Physics. The beginning was in Spring, 2001, when the colleagues of the former section Mathematics and Physics decided to start publishing our own book of the Proceedings of the Union of Scientists – Ruse. The first volume included 24 papers. Through the years there have been authors not only from the Angel Kanchev University of Ruse but as well as from universities of Gabrovo, Varna, Veliko Tarnovo and abroad – Russia, Greece and USA.

Since the 6-th volume the preparation and publishing of the papers began to be done in English.

The new 10-th volume of book 5 Mathematics, Informatics and Physics includes papers in Mathematics, Informatics and Information Technologies, Physics and materials from the Scientific Conference 'Information Technologies in Education' (ITE), held at the University of Ruse in November 2012 in the frame of Project 2012-FNSE-02.

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SOFTWARE SYSTEM FOR PROCESSING MEDICAL DIAGNOSTIC IMAGES

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***Abstract**: This paper proposes an approach to the design and implementation of a software system for processing medical diagnostic images. The system allows acquiring images from x-ray devices, ultrasonic echographs and endoscopic diagnostic devices. It maintains a database of patients' data and medical examination records, containing stored images and the doctor's conclusion. Utilizing this software allows improving the doctors' work in their practice outside the hospital when making diagnosis and tracking the treatment. The system can also be used for remote diagnostics (telemedicine).*

***Keywords**: Medical imaging, Diagnostic devices, Telemedicine, General practitioner, Medical software system.*

INTRODUCTION

The general practitioners' business activity has limited financial resources and the devices used in the medical offices diagnostic do not have the tools for storing the information in a database, assist the diagnostic process and use the results for remote diagnostics. The current paper describes a possible approach for the use of personal computers in the diagnostic activities in the general practitioners' offices. An Overview is given of a software information system for collecting, storing and organizing images from medical devices.

PROPOSED SOLUTION

With the progress of technology, the number of diagnostic devices, which create digital images [1] (radiography, ultrasonography etc.) in the medical science, is increasing. A lot of devices (endoscopes, colposcopes, microscopes etc.) can function with video cameras and the images created during the examinations can then be used for diagnostic purposes. To aid the diagnostic activities of the general practitioners and specialists is developed a software system for personal computer, which allows to:

- Get a live stream from medical devices, which support getting images.
- Give the possibility for recording a single frame or short videos of the conducted examination.
- Support a non complicated database for the patient data.
- Store a chosen set of images and the medical doctor’s conclusion in the database.
- Use the stored data for queries and monitoring the change in the patient’s condition.

The personal computer, used by the system, uses a video capture device, because most of the image diagnostic devices out of hospitals work with analogue video signals. The library DirectShow is used for processing the video signals. The software is developed in Borland Delphi [2] and because of that the free library DSPack is used, which is a set of components and classes for creating multimedia applications by MS Direct Show and DirectX technologies [4,5].

Fig. 1 shows the structure of DSPack as well as the class diagram of the most important class for the application implementation DSUtil.

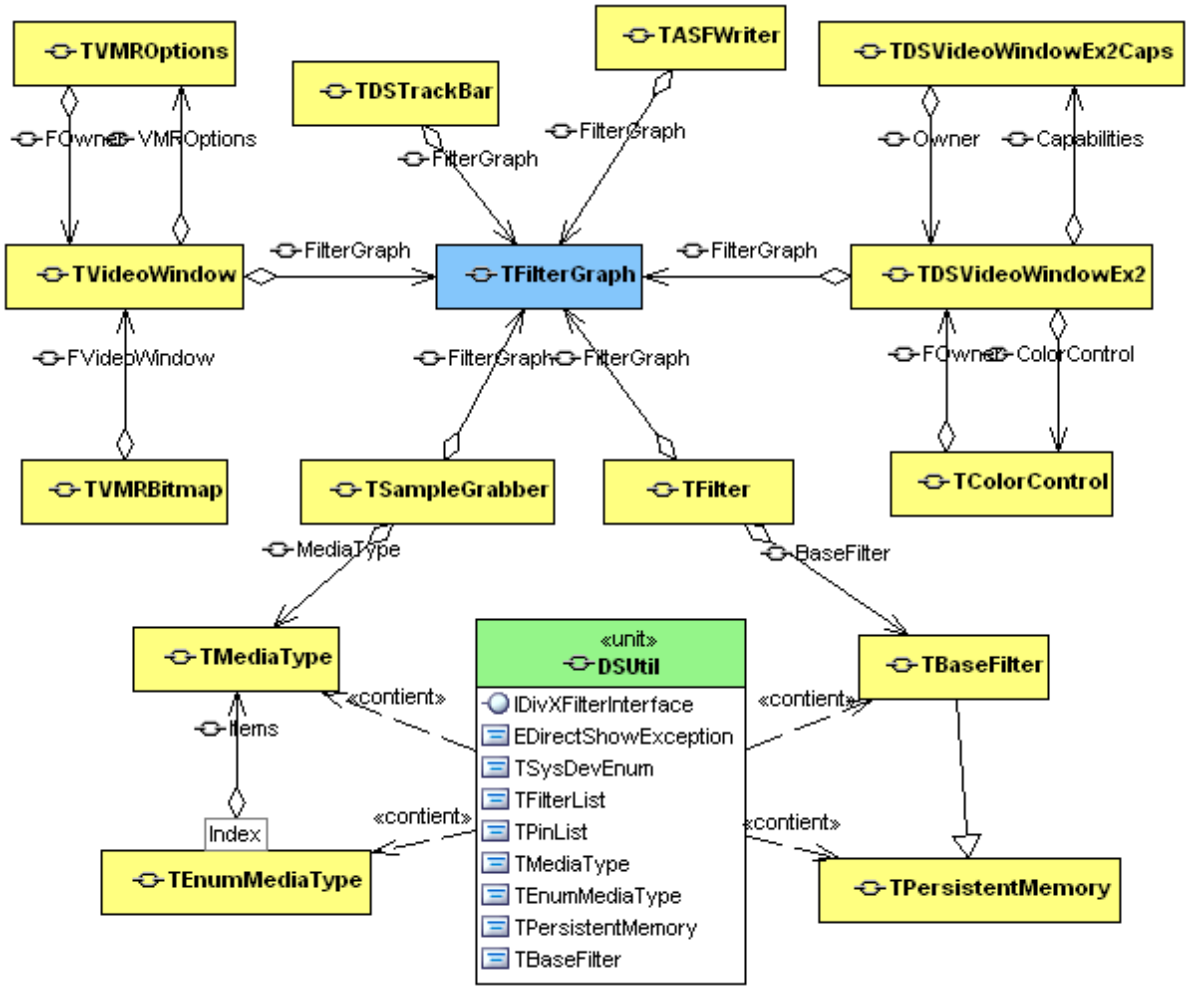

Fig. 1. Structure of DSPack

The software was implemented with an intuitive and user friendly graphical interface. After starting, the system is required to show not only the video stream but also the possibility for storing images and video clips. In fig.2 is the filter-graph, which is used to implement this functionality [4].

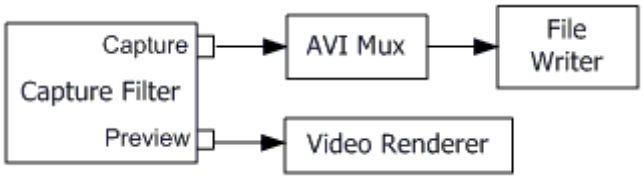

Fig. 2. DirectShow filter-graph used for video stream processing

After choosing the device and the video capture mode, automatically starts a preview of the incoming input stream (shown on fig. 3). After the preview has started and the examination begins the medical doctor has the resources to store a number of images from the diagnostic device. Regardless of the chosen number of pixels of the input image, it is scaled automatically to fit the appropriate window in the main view. The storing of snapshots can be done by pressing a button, keyboard shortcut or with the help of a specially designed for the purpose pedal, which is pressed with a foot by the medical doctor.

Fig. 3. System main windows after starting the video stream

When a single image extraction function is activated, the software system extracts the needed information from the input stream. To achieve this there are two possible approaches: to activate VideoCaptureGraph in the input stream or to extract it from the image preview. In the presented implementation, the second approach is chosen.

The images are stored in a temporary folder, accompanied with a timestamp, which can be used as unique identifier for the moment of extraction. The timestamp can be further used for storing the image into the patient's medical record together with the medical doctor's conclusion (if one was made). This information is also used when the snapshots are exported in the DICOM format, which is done with the purpose of using the functionality "telemedicine", which allows access on a more qualified diagnostic department.

The collection of snapshots during the patient's examination is being saved and at the end the medical doctor can choose to inspect again the records and filter the ones with diagnostic value, which can be further saved and can help for keeping track of the patient's condition (fig. 4). The same figure shows that the system can automatically take snapshots at specific intervals, which can free the medical doctor's attention and let him concentrate more on the examination.

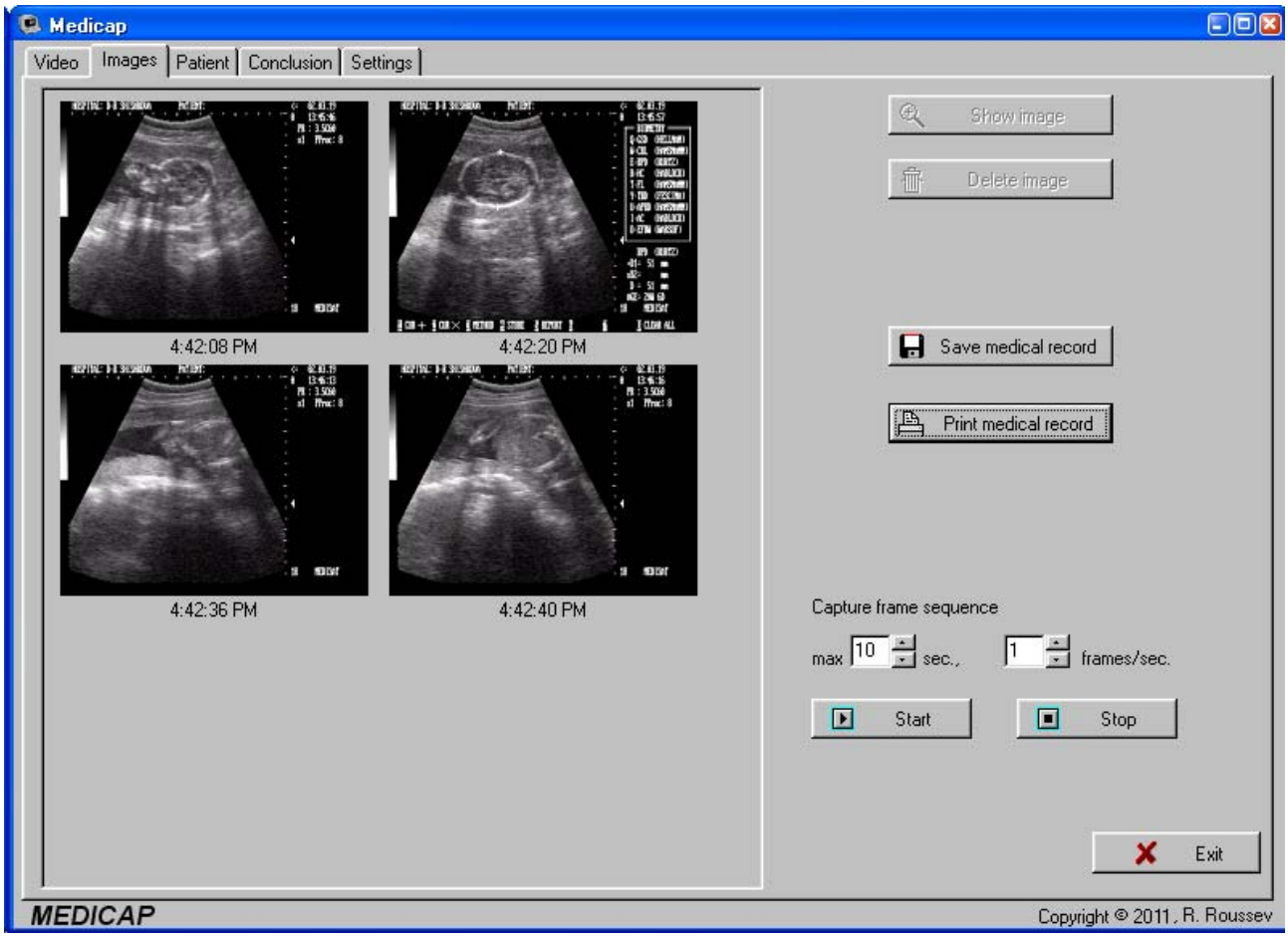

Fig. 4. Visualization of saved images

To achieve the collection of diagnostic information with the option of monitoring the patient's status the system supports a simple database. It stores the most important information about the patient as well as an unique identifier, which can be used for connection with a centralized database. (Fig. 5).

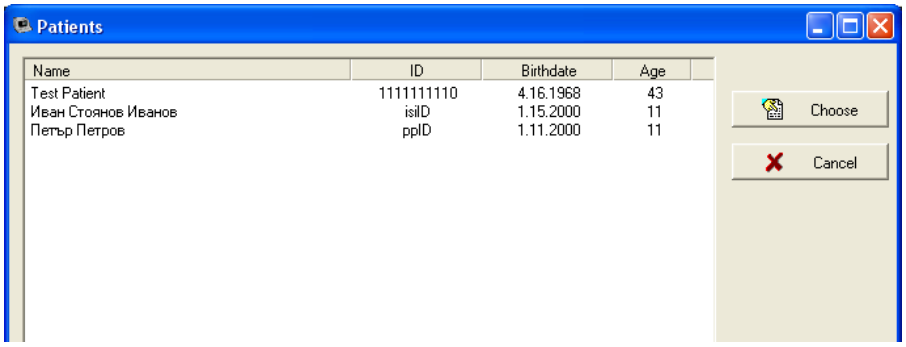

Fig. 5. Patients list in local database

If we want to save the medical record from the current examination or to browse the history of patient's visits, we can choose from the suggested list. The information for the past examination, diagnostic results and the written conclusions are visualized in a tree structure, which is extremely intuitive to work with (Fig. 6).

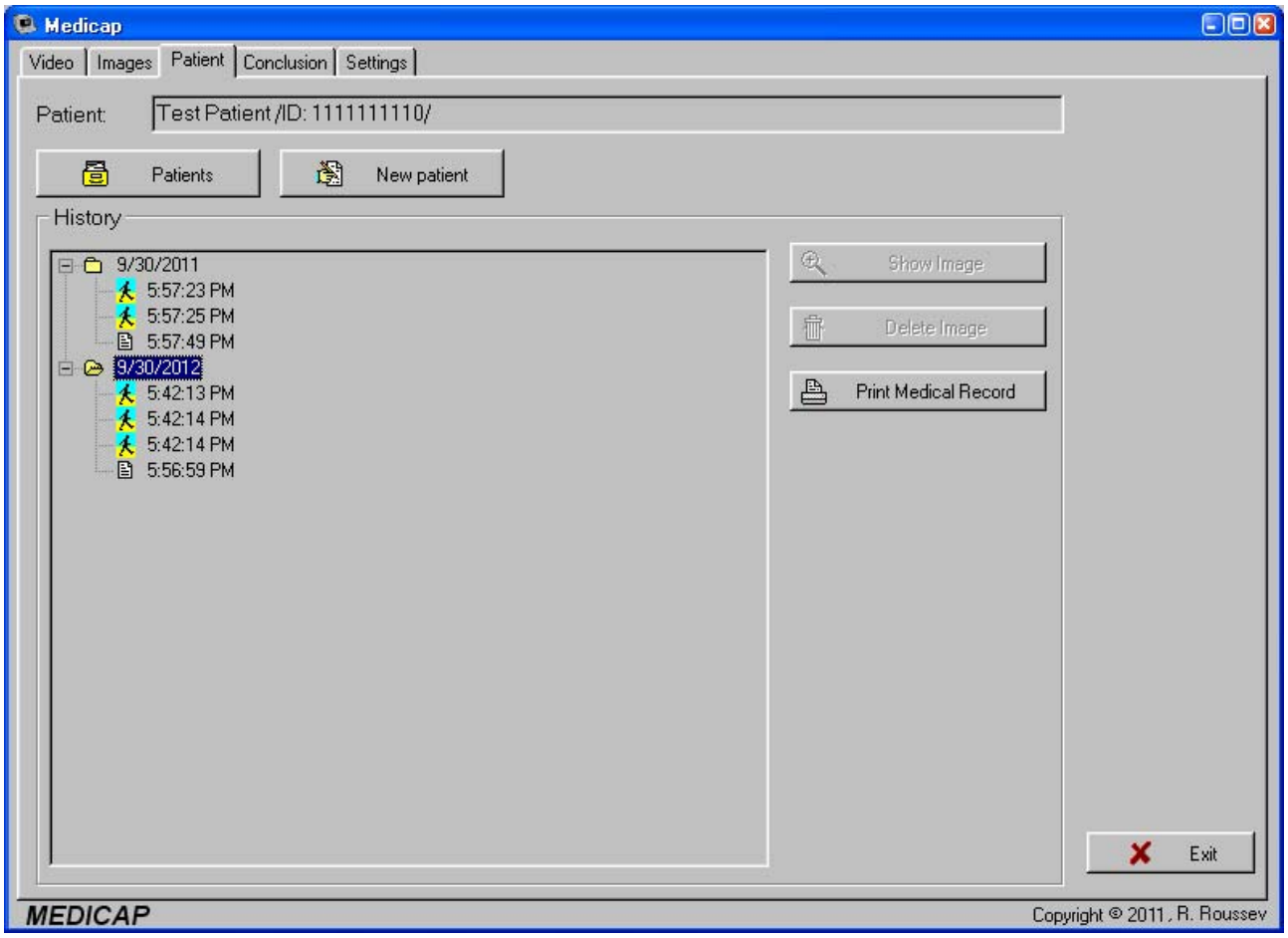

Fig. 6. Tree representation of collected patient's medical data

For simplifying the diagnostics process the medical doctor is offered a graphical editor, which has the option to load templates, on basis of which the diagnostic conclusion can be written. The usage of such templates drastically reduces the amount of paperwork the M.D. has to process, which prevents him from missing important elements in the description of the diagnostics. During any point of the process the medical doctor can choose to save a working copy of the collected data and print medical record of the exam, including any saved images if any and the examination conclusion. To ease the use, those functionalities are accessible during preview of the saved graphical mages, the preview of patient data in the database and during editing the conclusion.

The images are saved either in JPEG format with minimal data loss or in BMP without compression and therefore no data loss. The choice which of the two approaches to be used is a system parameter which is saved and can be edited in a configuration file.

Because some of the cases do not require systematical monitoring of the patient's condition and therefore no medical record is needed, the system can be used as a viewer for the images collected during the examination and/or printing a snapshot of them.

CONCLUSION

The developed software allows storing and managing images from medical devices for diagnostics through a multifunctional personal computer. The supplementary database is used to simplify the medical doctors' paperwork by saving texts, data, and the examination conclusions. The images and the conclusions are saved in a database for patient's medical history. It is stored as medical records and can be used for queries, monitoring the patient's state and for the need of remote diagnostics. The developed

software is used in practice from general practitioner medical doctors and other specialists. Its usage shows good functionality and is simplifying the M.D.'s practice.

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ПРОГРАМНА СИСТЕМА ЗА РАБОТА С ИЗОБРАЖЕНИЯ ОТ МЕДИЦИНСКА АПАРАТУРА ЗА ОБРАЗНА ДИАГНОСТИКА

Румен Русев

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Резюме: *Статията разглежда подход при проектиране и реализация на програмна система за работа с изображения, получени от медицинска апаратура за образна диагностика. Системата дава възможност да се получат изображения от ренгенови апарати, ултразвукови ехографи, и ендоскопски уреди за диагностика. Програмната реализация поддържа база от данни за пациентите и медицинските записи от проведените прегледи, съдържащи съхранените изображения и заключението на лекуващия лекар. Използването на софтуера дава възможност да се подобри работата на лекарите в извън болничната практика по поставяне на диагноза, проследяване на лечението, както и да се използва за отдалечена диагностика (телемедицина).*

Ключови думи*: Медицинска образна диагностика, Диагностична апаратура, Общопрактикуващи лекари, Медицински софтуер.*

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