

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

BRNO UNIVERSITY OF TECHNOLOGY

FAKULTA INFORMAČNÍCH TECHNOLOGIÍ
ÚSTAV INTELIGENTNÍCH SYSTÉMŮ

FACULTY OF INFORMATION TECHNOLOGY
DEPARTMENT OF INTELLIGENT SYSTEMS

SIMULATOR AND TRAINER OF THE PANASONIC FZ7 CAMERA

BAKALÁŘSKÁ PRÁCE

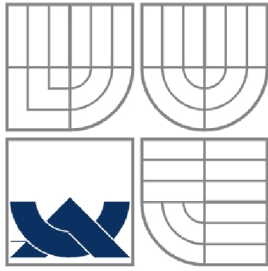
BACHELOR'S THESIS

AUTOR PRÁCE

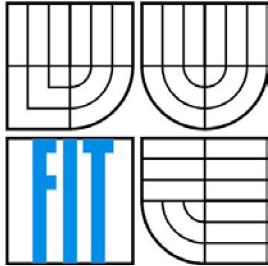
AUTHOR

BRANISLAV BIELIK

BRNO 2009



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FAKULTA INFORMAČNÍCH TECHNOLOGIÍ
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FACULTY OF INFORMATION TECHNOLOGY
DEPARTMENT OF COMPUTER SYSTEMS

SIMULÁTOR A TRENAŽÉR DIGITÁLNÍCH
FOTOAPARÁTŮ ŘADY PANASONIC FZ7
SIMULATOR AND TRAINER OF THE PANASONIC FZ7 CAMERA

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BRNO 2009

Zadání bakalářské práce

Řešitel: **Bielik Branislav**

Obor: Informační technologie

Téma: **Simulátor a trenažer digitálních fotoaparátů řady PANASONIC FZ7**

Kategorie: Modelování a simulace

Pokyny:

1. Seznamte se podrobně s obsluhou fotoaparátů řady PANASONIC FZ7. Vytvořte program pro prezentaci názorných fotografií, kterými budete demonstrovat, jaké možnosti poskytuje digitální fotoaparát v režimu "Prohlížení". Fotografie, včetně odpovídajícího popisu displeje fotoaparátu, vytvořte ve vhodném formátu.
2. Vytvořte podobně program pro prezentaci názorných fotografií v režimu "Fotografování", opět včetně ikon displeje fotoaparátu.
3. Navrhněte a implementujte program, který bude simulovat chování fotoaparátu v režimu "Fotografování" a který bude sloužit jako trenažér.
4. Zhodnoťte výhody a nevýhody navrhovaného řešení.

Literatura:

- <http://www.fotografovani.cz/zaklady/index.html>
<http://www.paladix.cz/>
<http://www.digineff.cz/>
- Návod k obsluze fotoaparátu PANASONIC FZ7

Při obhajobě semestrální části projektu je požadováno:

- Bez požadavků.

Podrobné závazné pokyny pro vypracování bakalářské práce naleznete na adrese

<http://www.fit.vutbr.cz/info/szz/>

Technická zpráva bakalářské práce musí obsahovat formulaci cíle, charakteristiku současného stavu, teoretická a odborná východiska řešených problémů a specifikaci etap (20 až 30% celkového rozsahu technické zprávy).

Student odevzdá v jednom výtisku technickou zprávu a v elektronické podobě zdrojový text technické zprávy, úplnou programovou dokumentaci a zdrojové texty programů. Informace v elektronické podobě budou uloženy na standardním nepřepisovatelném paměťovém médiu (CD-R, DVD-R, apod.), které bude vloženo do písemné zprávy tak, aby nemohlo dojít k jeho ztrátě při běžné manipulaci.

Vedoucí: **Kunovský Jiří, doc. Ing., CSc., UITS FIT VUT**

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Abstrakt

Bakalářská práce Simulátor a trenážér digitálních fotoaparátů řady Panasonic FZ7 se zabývá návrhem a realizací výukových manuálů a trenážeru pro tento digitální fotoaparát. Aplikace bude sloužit na podporu výuky na Univerzitě třetího věku. Implementace je pomocí Adobe Flash a programovacího jazyka ActionScript. Jsou zde popsány základy fotografování jako aj tvorby aplikací v prostředí Flash. Simulace umožňuje vyzkoušet možnosti zařízení při výuce a manuál přehledným způsobem vysvětlí základní použití fotoaparátu.

Abstract

The Bachelor's thesis Simulator and Trainer of the Panasonic FZ7 Camera deals with a design and a realization of the training manual and the trainer for this digital camera. The application will be used to support the education at the University of the Third Age. Adobe Flash and programming language ActionScript is used for implementation. Basics of photography and application creation in Flash are described. Simulation allows trying possibilities of a device in teaching and manual explains basic usage of the camera.

Klíčová slova

Panasonic DMC FZ7, digitální fotoaparát, digitální fotografie, Univerzita třetího věku, výuka, simulace, trenážér, manuál, Flash

Keywords

Panasonic DMC FZ7, digital camera, digital photography, the University Third Age, teaching, simulation, trainer, manual, Flash

Citace

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Simulator and Trainer of the Panasonic FZ7 Camera

Prohlášení

Prohlašuji, že jsem tuto bakalářskou práci vypracoval samostatně pod vedením Doc. Ing. Jiřího Kunovského, CSc. Uvedl jsem všechny literární prameny a publikace, ze kterých jsem čerpal.

.....
Branislav Bielik
May 10, 2009

Poděkování

Na tomto místě bych rád poděkoval mému vedoucímu Doc. Ing. Jiřímu Kunovskému, CSc. za odborné vedení, za poskytnuté rady a konzultace a za ochotu a čas, který mi při tvorbě práce věnoval.

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Tato práce vznikla jako školní dílo na Vysokém učení technickém v Brně, Fakultě informačních technologií. Práce je chráněna autorským zákonem a její užití bez udělení oprávnění autorem je nezákonné, s výjimkou zákonem definovaných případů.

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1 Introduction

Photography plays an important role as a showcase of communication medium, but also as a tool for science and technology. Photography is also a form of an art and is popular with wide range of people. Photography became a favourite hobby shortly after its invention. During the years of existence has changed many, except film, which had to be inserted into each camera. At present, however, there is twilight of traditional photographic film, thanks to the invention of the image sensor CCD (charge coupled device), which converts light to digital signals and these can be saved as a picture.

Thanks to the increasing quality and decreasing price, became digital camera common day stuff. The first mass use camera became available at the turn of the 20th century and today there are hundreds of models available for the amateur as well as the professional.

And because of that amount of models is hard for standard user to decide which camera to buy. Also there is a problem with operating, especially for older people without technical knowledge. Product manuals are full of information, but common users want to take, view and store photographs, not to read hundreds of pages to do that.

This thesis is concerned with creating manual for camera and creating camera simulator. This simulator will help in teaching people in University of the Third Age. And it can be also used as a presentation of the camera product for the company. It will be created for specific model – Panasonic Lumix DMC FZ7.

In Chapter Preliminaries are described basic facts about the digital photography, continued with Panasonic FZ7 introduction and problems with purchasing the digital camera generally. This chapter finishes with theoretical information about terms from simulation.

In Chapter Flash basic Flash and ActionScript preliminaries are given.

Solution suggestions for creating of the application are discussed in Chapter Solution Suggestion. In this chapter are also known problems presented.

In Chapter Implementation is process of implementation described along with solution of accrued problems.

Main results are presented in Chapter Final Application, where are cons and pros, possible further project extensions and user evaluation discussed.

2 Preliminaries

In this chapter will be introduced some basic facts about photography and taking photos. Next we will focus on specific model of camera. Problems with camera purchase will be described, especially by people without technical knowledge and possible solution. Next it will be about theoretical background for this thesis. And finally there will be discussed the main goal of this thesis.

2.1 Basic Facts

Every camera is made of two basic parts, the lens and the camera body. First thing we need to decide is to choose the level of control. Taking a photo can be very easy. Just turning camera on, pointing it and pressing the shutter button. Automatics will make a photo with the best adjustments as it can. But in bad light conditions it fails. Advanced cameras allow us to take more control of this process and in most cases allow taking better photos.

Digital cameras capture a limited range of brightness. If a digital image is underexposed, these parts are simply black, or if it overexposed these areas are simply white, without details. Exposure controls the amount of light which reaches the image sensor. The aperture and shutter work together to control amount of light. The relationship between aperture and shutter is known as reciprocity, because if we want to make shutter speed faster, we must compensate it by having the aperture open wider.

Aperture defines the size of the opening in the lens. Aperture is measured in f-numbers. Discussion of f-numbers is counterintuitive in that the larger the number, the smaller the opening of the lens. The unit usage of f-numbers appears like: $f/2$, $f/4$ or $f/5.8$.

Shutter speed defines the exposure time. It is the time for which the shutter is held open during the taking of a photograph to allow reaching the sensor. Shutter speed is measured in seconds or fractions of a second $1s$, $1/30s$ or $1/60s$.

In film photography, ISO measured the sensitivity of the film used. The more sensitive the film, the less light required to make an appropriate exposure. Consequently, the more sensitive the film, there is a noticeable increase in grain. In digital photography, the metaphor is maintained. The more sensitive we tell our sensor to be; the less light we need to create an exposure, but it will also be more sensitive to noise. There is always a correlation between ISO and noise. However, the amount of noise present at a particular ISO setting is dependent on the specifications of the image sensor and then every camera is different. Professional level cameras have less noise for each of the ISO settings compared to the same settings on consumer level cameras.

Cameras have a lot of other settings and characteristics. The most important are field of view, or zoom and resolution of sensor. The field of view is that part of the world that is visible through the camera at a particular position. Zoom lenses are a special case wherein the focal length of the lens can be altered mechanically without removing the lens from the camera. Longer lenses magnify the subject more, apparently compressing distance and, when focused on the foreground blurring the background because of their shallower depth of field. Wider lenses tend to magnify distance between objects while allowing greater depth of field. Resolution provides an indication of the amount of detail that is captured. The relative increase in detail resulting from an increase in resolution is better compared by looking at the number of pixels across the picture, rather than the total number of pixels in the picture area. For example, a sensor of 2560×1600 sensor elements is described as "4 megapixels" ($2560 \times 1600 = 4,096,000$). Increasing to 3200×2048 increases the pixels in the picture to 6,553,600 (6.5 megapixels), a factor of 1.6, but the pixels per cm in the picture at the same image

size increases by only 1.25 times. A measure of the comparative increase in linear resolution is the square root of the increase in area resolution, in other words, megapixels in the entire image. Resolution in pixels is not the only measure of image quality; a larger sensor with the same number of pixels will generally produce a better image than a smaller one. One of the most important differences is an improvement in image noise. This is one of the advantages of digital SLR cameras, which have larger sensors than simpler cameras of the same resolution.

It is likely that film will never again be purchased and used on the scale it was for most of the 20th century. However, it probably will not disappear altogether. Of growing concern for both archivists and historians is the relative non-permanence or transitory nature of digital media. Unlike film and print, which are tangible and immediately accessible to a person, storage of digital images is ever-changing with old media and decoding software becoming obsolete or inaccessible by new technologies. It is recommended that both professional and amateur users develop strategies for migrating stored digital images from old technologies to new. This part was based on [2, 6], so for further information please consult these sources.

2.2 Panasonic Lumix DMC FZ7

The Panasonic DMC FZ7 is a six megapixel digital camera with twelve times optical zoom lens. The lens has a focal length of 36-432mm in 35mm format. There is also a 4x digital zoom feature. For close up photography the macro mode will get us in as close as 5cm from our subject. For composing images we can choose between electronic viewfinder and the 2.5" LCD screen. The screen is made up of around 114 000 pixels. The built in pop up flash unit has a maximum range of 5m. It should also be noted that full six megapixels are only available when using the 4:3 aspect ratio. With 3:2 ratio the number of megapixels available drops to 5 and in 16:9 ratio the number of megapixels available drops to 4.5. To add something different to our photos we can apply the colour filters. These are Cool, Warm, Black and White and Sepia. When we would like to appear in the picture ourselves there is a self timer. This can be set to either two or ten seconds. We can take full control over the exposure by using the fully manual exposure mode. Aperture priority and shutter priority are available too. Shutter speed can be set in the range 60 – 1/2000 seconds. Available apertures are in the range of Wide: F2.8 – F8 and Tele: F3.3 – F8. If we are looking for something in between automatic and manual modes then we will find wide selection of predefined scene modes. All we need to do is select the most appropriate scene and the camera will choose the optimum settings for the photo. The scene modes are Portrait, Soft Skin, Sports, Scenery, Night Scenery, Panning, Night Portrait, Fireworks, Party, Food, Candle, Starry Sky, Baby1, Baby2, Snow and High Sensitivity. Among the more advanced settings is exposure compensation (1/3 EV step, -2 - +2 EV), Auto (AE) Bracketing (+/- 1/3 EV -1EV step, 3 frames), light metering (Intelligent Multiple, Center Weighted and Spot) and ISO sensitivity (Auto/80/100/200/400 and in High Sensitivity Mode: Auto/800/1600). There are also a number of white balance settings to choose from. These are Auto/Daylight/Cloudy/Halogen/White Set White Balance Adjustment (150K step, -1500 - +1500 K). Manual focusing is available too. There are two types of burst or continuous shooting modes. The first allows us to take up to seven shots in fine mode and 13 shots in standard mode. This can be at a maximum rate of two or three shots per second. The second allows us to keep firing off shots until the memory card is full. This one is at a slower frame per second rate. After we have taken a picture, we have options to trim or crop the image and also produce a smaller copy. The smaller copy could be suitable for emailing or posting to the internet. We can also add ten seconds of audio to an image. This can help us to remember what was happening at the time the picture was taken. A similar feature allows us to record up to five seconds of sound when the picture is actually being taken. To help reduce blur optical image stabilization is

available. We can shoot movies up to the capacity of the memory card. There is a special setting to record for widescreen televisions. This shoots at a resolution of 848 x 480. The standard 640 x 480 resolution is also available. A maximum frames per second rate of 30 is available for both resolutions. Changing zoom during recording is not available in movie mode, but sound can be recorded.

Changing the shooting mode is controlled by a dial on the top of the camera. To set the flash and other important buttons are available on the back of the camera. Zoom is controlled through a ring around the shutter button. For anyone who would like to use the camera as a point and shoot model there is a special Easy Mode. This reduces menu options to a minimum.

Compare with many super zoom digital cameras the Panasonic DMC FZ7 is slightly more compact and smaller. It is available in silver and black. It weighs in at 310g and has dimensions of 112.5 x 72.5 x 79.0 mm. A rechargeable lithium ion battery is used to supply power to the camera. Panasonic supplies both a battery and charger with the camera as standard. Panasonic estimates we can take around 320 photos before the battery will need to be recharged. Also a 16 MB SD card is supplied with the camera, because of it a bought of a new high capacity card is requirement. There are also all the necessary cables and software to connect the DMC FZ7 to a computer via USB 2.0, television set and a PictBridge compatible printer. This part was based on [7, 8].

2.3 Problems with New Technology

In these days there is a big amount of different models of digital cameras on the market, from well known manufacturers to less known. For customer without appropriate knowledge, the bought of digital camera is a significant problem. One option is to ask for assistance offspring, who have more experiences with using of this technology. However, if there is no such option, they must study available literature or use an internet as a source of information. Option of internet resources has one big problem. By searching they probably found manufacturer or dealer sites and they will lose in parameters and information presented there. Another option is to rely on salesman, which is mostly the worst possible solution, because they want to sell not to explain and teach. Frequently there is a problem coming from fear of usage. Especially by, at first sight, more sophisticated models. Users might have scare, this type of device, even take into the hand. The simplest solution, which would improve the current state, is to teach this group of people to gain knowledge about a digital photography. Education in later life is not one of the easiest activities, but the existence of a university of the third age and interest in such courses suggest, that even among the seniors we can find people, who are interested in gaining knowledge and learning new technologies. A very important factor is availability of teaching and learning materials. These materials should provide a sufficient degree of interactivity and presentation of information. In case of digital camera is the best way to use a simulator.

2.4 Theoretical Background

In this thesis we will use terms like model or simulation. In this part we will gain some knowledge in modelling and simulation. First very important term is a system. A *system* is a set of interacting or interdependent entities, real or abstract, forming an integrated whole. [3] The entities of a system have functional as well as structural relationships between each other. [1] In our case a system is a digital camera. Next very important term is a model.

A *model* is a physical, mathematical, or logical representation of a system of entities, phenomena, or processes. Basically a model is a simplified abstract view of the complex reality. It

may focus on particular views. The degree of abstraction depends on the specific problem. What this is related the term modelling. [9]

A *modelling* is the process of generating abstract, conceptual, graphical and or mathematical models. One of the essentials is the understanding of the role that assumptions play in the development of the model. The usual approach to model development is to characterize the system, make some assumptions about how it works and translate these into a simulation program. [9]

After simulation one of the final steps is the *validation*, where we decide, whether we can trust the data presented by the model. [9]

And finally there is a simulation. A *simulation* is the imitation of some real thing and it is also method of gaining new knowledge about the target system by experimenting with its model.

The usage of the simulation and the simulations methods are very common in these days. These methods are used in the situations, where experiments with real systems are dangerous, uneconomical, impossible or inappropriate. [1]

2.5 Main Goal

The main goal of this thesis is to create teaching materials of the Panasonic DMC FZ7 camera for the University of the Third Age. Application requirements for this type of program are clarity, comprehensibility, accessibility and illustration.

The result could be divided into manual and simulator. The first one will be used to give assistance to users of the camera by visual explanation of the basic settings and control. The second, simulator, will help people gain knowledge in operating the camera. It should solve problems mentioned in Section *Problems with New Technology*. The gained knowledge could be used in real life with real camera not only of this concrete model.

The final application will give opportunity to user to choose between various models of digital cameras, because similar themes with different camera models were elaborated by students.

3 Flash

In this chapter, I will describe used terminology and methods from development for the Flash platform. This chapter is based on [5, 11].

3.1 History

The history of Flash started as the brainchild of Jonathan Gay, who developed the idea while he was attending college and extended it while he was working for Silicon Beach Software and its successors. In January 1993, Jonathan Gay, Charlie Jackson and Michelle Welch started a small software company called FutureWave Software and created their first product named SmartSketch. It was a drawing application for PenPoint OS (operation system) running on pen computers. SmartSketch was designed to make creating computer graphic as simple as drawing on paper. When PenPoint OS failed in the marketplace, SmartSketch was ported to Microsoft Windows and Mac OS. Next FutureWave began to realize the potential for a vector-based web animation tool that might be easily challenging Macromedia's Shockwave technology. In 1995, FutureWave modified SmartSketch by adding frame-by-frame animation features and re-released it as FutureSplash Animator on Macintosh and PC. The product was offered to Adobe and used by Microsoft in its early work with the Internet. In December 1996, Macromedia acquired the vector-based animation software and later released it as Flash, contracting "Future" and "Splash" of the FutureWave name. In 2005 was Macromedia bought by Adobe. In April 2007 Flash CS3 is the first version of Flash released under the Adobe name. At the time of this writing, Adobe Flash CS4 Professional is the last released, and we will use it for developing our application.

3.2 Flash Environment

Application in Flash consists of frames. These frames are part of the timeline. Basically Flash application is one big animation, which is played as the playhead goes from one frame to another.

All graphics we create inside Flash are vector based. A vector graphic contains the math to redraw the image on screen. For example, a circle includes information such as the radius, the line thickness and the colour. So we can scale the image to any size without any degradation of the image quality.

In the Flash we can also use bitmapped graphic, called raster graphic too, which are fundamentally different from vector graphic. A raster graphic file contains the colour information for each pixel. As a result, raster graphics are almost always relatively large files and also cannot be scaled very effectively.

Into the Flash we can import many file formats. So we can easily create images, audios or videos in other applications and import them into the Flash. These files are imported directly onto stage or into library, from where we can anytime take and place into the movie or load dynamically at runtime.

Another most common term in Flash is symbol. A symbol is a reusable object used in Flash. A symbol can be reused throughout our movie or imported and used in other movies. There are three types of symbols: Graphics, Buttons and Movieclips.

Graphic symbols are reusable static images that are used mainly to create animations. Any drawn vector, plain text or imported bitmap, or combinations of these, can be converted into a single controllable object. They have only one frame in their timeline.

Button symbols are used for timeline navigation. They add interactivity to the movie and respond to mouse clicks, key press and other actions. We need to define graphics associated with various button states, namely Up, Over, Down and Hit. Then we need to assign actions to the instance of a button. They have four frames in their timeline, one each for the up, over and down states, and one to define the hit area of the button.

Movieclip symbols are reusable pieces of flash animation, consisting of one or more graphic or button symbols. They have their own non-restricted timeline that plays independent of the main movie's timeline. The best thing about using Movieclips is that we can control them from ActionScript. We can change their dimensions, position, colour, alpha and other properties and can even duplicate and delete them.

The IDE (Integrated development environment) for Flash consists basically of main workspace, where we can see the look of the current frame. The other parts of workspace we can add or remove as we wish or there are preset workspaces for animation, debug, design or development. For example there are panels named Timeline, Motion Editor, Tools, Properties, Library, Actions, Movie Explorer and about thirty others. As with other professional Adobe Creative Suite applications, the interface can be incomprehensible for beginners, but it offers many welcome improvements to its look and feel, so it is far more attractive than previous versions of Flash.

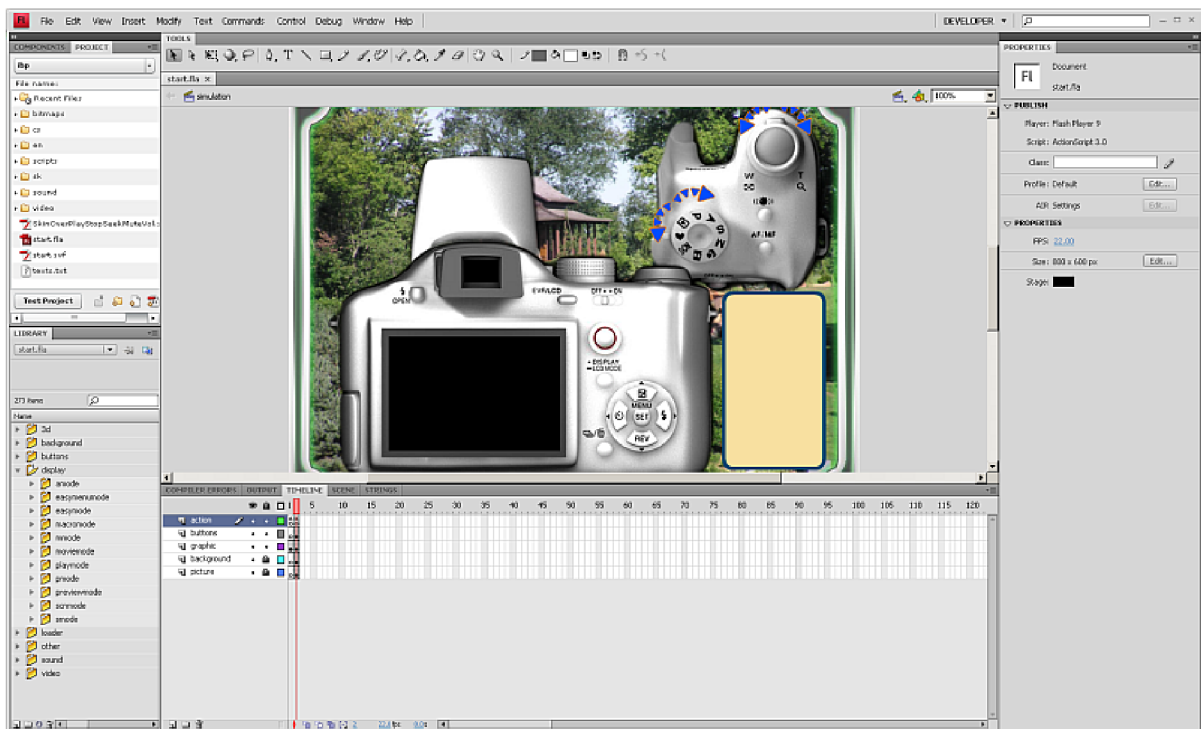


Figure 3.1: Flash interface

3.3 ActionScript 3.0

ActionScript started as a scripting language for Macromedia's Flash authoring tool. In early versions of Flash authoring tool provided limited interactivity features. Developers could attach a simple command, called an "action", to a button or a frame. The set of actions was basic navigation controls, with commands such as "play", "stop", "getURL" and "gotoAndPlay". With the release of Flash 4 in 1999, this simple set of actions became a small scripting language with new capabilities included variables, expressions, operators, if statements and loops. [12]

When ActionScript 3.0 was released, the Flash Platform split into Flex, for developers, and Flash, for designers. It was expected that a new version of ActionScript will bring with it new features, however, this version has been written anew from the ground up and is even handled separately from previous versions of ActionScript at runtime.

The key capability of ActionScript 3.0 is object oriented programming (OOP). In addition it is still possible to code in the timeline, and we can combine it with usage of external classes. Next new features include more detailed error reporting, strict data typing, syntax issues have been unified and cleaned up throughout the language, new display architecture with display list, new event architecture with fielding by event listeners, improved XML (Extensible Markup Language) handling, new regular expressions, more sound management options and new access to raw binary data such as reading individual bytes of data during download.

We will primary develop our ActionScript 3.0 application using the Flash CS4 Professional. However, ActionScript 3.0 is the programming language for other Flash Platform applications, as well notably Flex and AIR (the Adobe Integrated Runtime desktop delivery application).

ActionScript code is free form and thus may be created with whichever amount or style of whitespace that the author desires. The basic syntax is derived from ECMAScript, which is a scripting language, standardized by Ecma International, and this language is widely used on the web, especially in the form of its two most well known dialects, JavaScript and JScript. The following code shows the basic example with Hello World:

```
var greet:TextField = new TextField();
greet.text = "Hello World";
this.addChild(greet); // displayed in player
trace("Hello World"); // displayed in output window
```

4 Solution Suggestion

The first step in these types of theses is always observation and exploration. Next we need to create an abstract model, which is a simplified view of the complex reality. After the complete analyse of an abstract model, the process continues with creating of the simulation model. This simulation model is written in program form. After completion of this task, this model will simulate our model. The last parts of this process are testing followed by analyse.

The simulation model can be written in various programming languages such as Java, C# or ActionScript from standard programming languages, or in original simulation languages such as Simula, Modelica or Simgua. Because an ActionScript, as a part of Flash, which is complete solution for animation and programming, was already used successfully in many previous cases, it will be probably the best choice in our case too. The new ActionScript 3.0 is a powerful object-oriented programming language, which provides superb performance and ease of development to facilitate highly complex applications and object-oriented, reusable code bases. [10]

4.1 Getting Camera Screen Shots

To create a user friendly program we need to assemble a lot of graphic materials. There are basically two different approaches to achieve the same goal, to take a camera screen shots. First one is to use another camera to take the photos of our camera screen. The second is to record from the video output of our camera. There are a lot of arguments against the first approach. It is because of a complicated process of the taken pictures' modifications. Two different final pictures will never look the same and the user will notice the weird jumping of the screen. The capturing the video output has a lot of arguments for. There is the same position, size and colour balance of the taken screen. Unfortunately we were unable to use this type of capturing. It was because the manufacturer did not allow the output while we are taking the photos. It is only enabled in presentation mode, what we did not exactly require. So we decided to use the first approach, the usage of the second camera. But because of significant negatives, we use these shots only as a template for creating the graphic objects for usage in our future program.

4.2 Manual

The manual will be a document, which is intended to give assistance to people using real model of our camera. There will be a visual explanation of the basic settings and controls. The first idea was to create the new camera manual in form of the classic presentation with PDF (Portable Document Format) as a final format. This format of the manual is good for its portability, but there will be a problem with multi language support. If we want to add a new language, we will translate the source file and create whole new file. It will be very annoying and because of this we choose Flash as a suitable format for the manual. The idea of using the Flash as a manual is good from many aspects. The Flash is more interactive and multimedia format than PDF. We can use videos demonstrating the capabilities of the camera, or, as the main point, the Flash has an option to load texts within program dynamically. And the new version of the Flash has multi language support included, so there will be no problem adding new language in xml file. And finally, if the manual is a part of our program, the user will not need to install any additional program.

4.3 Simulator

The leading part of this thesis is the camera simulator. The main goal is to develop an application, which will help users gain knowledge in operating the camera and help them in decision, if this type of camera is that, they are looking for. This application should have intuitive and simple interface. There is no need of true simulation of taking photos, but it is focused on the camera behaviour and operation. As we said before, we will use the Adobe Flash CS4 Professional as a developing environment. We will use the object oriented approach and the layered application design. We will primary use the two layers, business and presentation. The data layer will not be needed in our case, except the loading external language files. But this is default implemented in the Flash. As the output format we will use SWF (Shockwave Flash). This file format can be run in different ways. The first way is by the Adobe Flash Player, which is distributed free. The next option is by any web browser with Flash plugin installed. The last option is creation of projector, which is the animation itself with SWF player in one file as the executable file for the target platform. By the last option we lose transportability.

4.3.1 Operating Elements

The Panasonic FZ7 has a lot of operating elements. These controls are placed on the top (Figure 4.1) and the back (Figure 4.2) of the camera. There are some common controls like mode dial and shutter button on the top and on/off switcher, cursor buttons and set button on the back.

The mode dial sets the camera mode and can be rotated 360°. The camera offers program auto exposure mode, aperture priority auto exposure mode, manual exposure mode, macro mode, motion picture mode, scene mode, simple mode and playback mode. The mode can be set up independently of the current state of the camera.

The next common control is the shutter with the zoom ring around it. The shutter and the zoom ring are used for taking photos only. With pressing the shutter halfway the camera focuses and with pressing it fully the camera takes the picture.

On the top of the camera are another two buttons, focusing mode selecting button and optical image stabilizer button. The functions of these buttons are available in every mode except the simple mode.

The largest part of the back of the camera is LCD (Liquid crystal display) monitor. The other displaying device is the electronic viewfinder. On its left side is the flash open button. It is working independently, because it is mechanic button. On the viewfinder's right side is viewfinder, LCD switcher, which works in every state of the camera autonomously too.

The last independent button is the on/off switch. Under it is the joystick, which is used primary in modes with word exposure in the name, for set up the values of the shutter speed or aperture.

The next button is a display, LCD mode button. This button has different function in different modes. In simple mode for example it only turns off the information on the screen. Another button is used for selecting between single or burst mode and for deleting pictures.

The last are five buttons primary assigned to browsing the menu, but out of it the cursor buttons have different meaning. The right button is used for setting the flash. The left button is used for self timer. With the up button we can adjust exposure and other settings for taking the photos. And the down button is for checking the recorded picture.

Because we have two electronic displaying devices, on each is the same picture, but not at the same time. The display is the key part of the simulator, because the change of the state will be seen on it.



Figure 4.1: Operating elements on the back of the camera



Figure 4.2: Operating elements on the top of the camera

5 Implementation

In this chapter is described the workflow by creating the final application step-by-step. We will start with the first phase of creating the model of the camera, then we will continue with the rotation mode, afterwards the simulation mode will be described and in the end we will make clear manual's creation.

5.1 Model Creation

On the first phase of the implementation we decided to create 3D (three dimensional) model of the Panasonic FZ7 camera. It was because we will need the photos of the camera, almost from every angle, in later parts of the work.

We chose Cinema 4D as the modelling and rendering software for our model. Cinema 4D is 3D graphic application, produced by MAXON Computer. It was chosen because of ease of use and previous experiences with this software.

We created the model of the camera as accurate as possible, so it can substitute the photos of the real camera. On the Figures 4.1, 4.2 and 5.1 we can see the final model. We did not need to wipe away background from the edges of the object, we just simple rendered it on the white background. It is much simpler to render it from desired angle than taking photos of the camera with following retouching.

The creation started with main body modelling. We took the pictures of the real camera from six views to have enough information about the object. After the polygonal model of body was finished, we continued with modelling buttons, camera lens and other details of the camera. Finally we added the textures to make it look real.

The time spent with this part will save our time later. The renders of the model will be used in rotation of the camera and in the simulator.

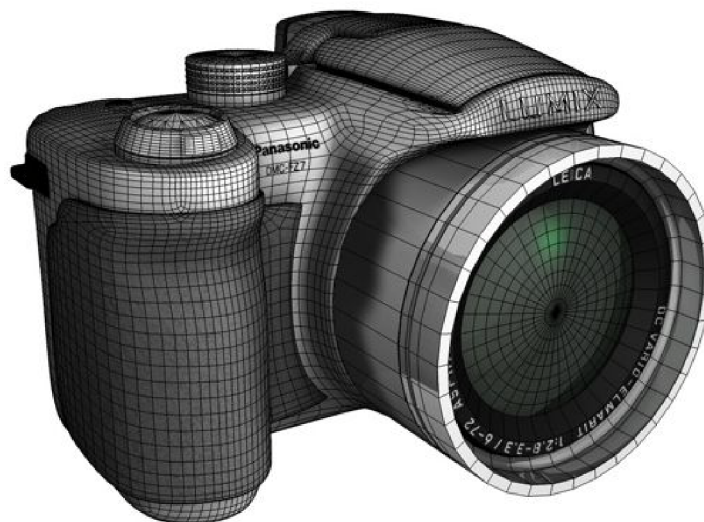


Figure 5.1: The camera model

5.2 Rotation of the Camera

The next part of implementation we were working on was the rotation of the camera. This was the first feature added into the application. It was the part we were learning Flash in. This part is meant to be for seeing the camera from every angle, to give the user possibility to imagine how the real camera looks like.

The first idea was to use the created model of the camera in some 3D representation feature of the Flash. We found, for example, Papervision3D, which is the open source real-time engine for Flash. But after the studying of possibilities of this and other 3D engines, we figured out that the Flash is still too slow for model like ours. This engine could be used for models with the count of polygons under ten thousand according to the forums.

So we used the standard way. The Cinema4D had rendered the series of thirty shots of a model with 360° rotation. Then we prepared the Movieclip with these images inside. After that we wrote the code, which controls the rotation. It used the way of control of the mouse dragging. The user can simply rotate the model of the camera without the notice, that it is only the set of images. After the detection, that the rotation with mouse is not oblivious for everyone, we decided to add standard buttons too. The previous functionality stayed untouched, we just added the option of rotation by the buttons.

This part of our application was not one of the main goals of our work, so we did not pay attention to this section more. The description of the camera will be presented in the manual, so there was no need to describe the camera operating elements in the rotation.



Figure 5.2: Rotation mode

5.3 Simulation of the Camera

In this section we will clarify the leading part of this thesis. We will gradually describe all the pieces used to create this simulation mode.

5.3.1 Presentation Layer

The presentation layer typically provides the application's user interface (UI). It is used for interaction with the user. It is that part of the application, which displays output from lower layer and collect user input.

The main goal of this section was to create camera interface, which should have operating environment as common as possible. First target was to figure out, how to display the upper and rear side of a camera, because both sides have operating elements, as it was mentioned before. The top side contains all necessary parts only on its right side, so it was not necessary to show whole camera from the top. On the Figure 5.3 we can see the final layout.

We continued with creating buttons and other operating elements of the device. For the buttons was created the new layer in Flash. The simplest ones were the buttons. There were used standard Flash button symbols. For others were Movieclip symbols used. For mode dial we needed compute the angle of rotation by the mouse to determinate, when its rotation enough to change the mode. For joystick was required position of the mouse click, because there are five possible positions – up, down, left, right and middle. Another special case was the shutter button, where was used event for mouse over the symbol, for simulate pressing the shutter halfway.

All elements of the interface resides on one frame, where is also entrance point of the simulation for ActionScript. There are added all event listeners for every item on the stage. These listeners call the *Action* class, where are defined reactions on the events. In script on this frame are also initialization of the needed classes and variables.

Because handling of the mode dial and especially zoom ring was not as intuitive as it was assumed, there were added arrows for control these objects. And as it was advised we created the information button that informs about actual state with short description and highlights the active buttons. To show it we need only to move mouse over the button. All texts used in this box and everywhere else are localized according to chosen language.

Because every mode has a different display, there were created generally one frame's Movieclips for each camera mode. These displays exist in library and they are dynamically assigned to the states through initialization. The displays consist of elements, which could be controlled by ActionScript. For example the size icon Movieclip has three frames labelled with different photo size names.

All icons are created from pictures of display. These pictures were used only as template, so every icon was created from the ground. This process was time consuming, but it looks better in final application.



Figure 5.3: Simulation mode

5.3.2 Business Layer

Business logic term we used to describe the functional algorithms that handle information from user input and give the results for an output. We created six classes for handling these issues.

The *State* class is representing the state of the camera. It contains two needed members – name of the state and display, which belongs to this state. By the initialization these properties are set. It contains

The *StateChange* class is used for store the current state and previous state. And if current state is changed, it dispatches event. This event is caught in entrance point and according to current and old state it handles the situation, but by default it sets the old state's display visibility to false and current to true.

The *StateProp* class is used by the whole application for getting and setting static variables. It contains variables such as card size available, display position or zoom level.

The *Display* class represents the display of the camera. It can switch between LCD monitor and viewfinder.

The *Photos* class handles camera's memory for taken photos. There are methods for adding, deleting and browsing through photos.

The *ActiveButtons* class is responsible for highlighting the active buttons in current state. Methods in this class control the Movieclip with highlight effect for each button. For example the *SetActive* method has the array of buttons names as a parameter and these buttons are highlighted inside.

The *Action* class's methods are called from presentation layer. They react on pressed button or moved zoom ring by appropriate action according to actual state. In a lot of cases the function of the button is different, so the different action is needed and on the other hand there are cases, in which the button has the same function through all states. These methods have a direct access to current state's display, so they can change icons on screen, change zoom level or take a photo.

5.3.3 Data Layer

This layer provides simplified access to data stored in persistent storage of some kind, in our case it is XML (Extensible Markup Language) file. We use xml files for multi language support in our application. Each XML file represents one language. It is used special XML Localization Interchange File Format (XLIFF). There are pairs of string ID (identification) and language specific string. To load these texts from XML file we use built in methods of the *Locale* class. As we can see on following code, first we need to set language we require, then XML language file is loaded and finally language specific string is loaded according to string ID. The last method *loadString* returns localized text.

```
Locale.setDefaultLang("en");
Locale.loadLanguageXML(Locale.getDefaultLang());
Locale.loadString("IDS_MANUALINTRO");
```

5.4 Camera Manual

In this subchapter will be discussed the way we were creating the manual for Panasonic FZ7. As we did not want to follow old methods, we chose the new one, very popular in these days. We said in chapter 4.2 Manual, that we will use Flash environment for manual, because of its advantages. This

idea remains, but we changed the way of presentation. Instead of texts with pictures, we picked up the video. This approach meant different techniques.

The first problem was capturing the videos. Because we do not have adequate equipment for recording, we were forced to use available devices. The next digital camera was used as a capture device for video.

Process of creating each video for manual started with preparation of the texts. Because we were developing an application primary in two languages, we needed to translate this text into both languages. Then we recorded the sound track in the first language. With this sound playing, we captured the video. After that we recorded the second language track according to taken video. Then we converted this video with each language track into the FLA (Flash Video) format. Every video contains in its name the identification of a language. So adding by adding the new language each video must be converted with proper language track and correctly named, other is automatically done.

There are created four video manuals. The first is called *Introduction* and it is concern about the camera body, usage and basic facts. The second *Basics* is about simple mode of the camera and basic handling. In the third *Playback* is shown the review of taken pictures and deleting photos. And in the final longest *Other modes* all other modes of the camera are introduced.

For higher intelligibility we were trying to use well known words and terms applied in the supplied manual. The level of demonstration is probably the highest, because the spectator can see all operations in real time with real device.

Playing videos can be controlled by standard buttons for playing, stopping, seeking and controlling volume.



Figure 5.4: Camera manual

6 Final Application

As it was shown on figures in previous chapter, the final application was created to fulfil the requirements for the application of this type – it should be clear, comprehensible, accessible and illustrative. We think, we accomplish all these targets. In following subchapters will be described how application is added to web page, application requirements, user evaluation of the application, possible extensions and cons and pros.

6.1 Flash in HTML

The main advantage of the Flash is in possibility of export to wide range of file formats. The most common is SWF (Shockwave Flash). It can be played by Adobe Flash Player. To view it in web browser, we need plug-in for concrete browser. All these items are free to download on internet. We inserted the following code into the HTML (HyperText Markup Language) page where we want to insert our Flash movie.

```
<object width="800" height="600">
<param name="movie" value="start.swf">
<embed src="start.swf" width="800" height="600">
</embed>
</object>
```

In the code above there is both an `<embed>` tag and an `<object>` tag. This is because the `<object>` tag is recognized by Internet Explorer. Other browsers recognize the `<embed>` tag and ignores the `<object>` tag. This is the minimum code we needed to embed a Flash movie in a browser. A broken icon will appear on the web page if the user not have Flash plug-in installed. There should be a few more attributes added. The first is *classid* which is an attribute to the `<embed>` tag. It tells Internet Explorer to load the ActiveX plug-in if it is not installed. The next *pluginspage* is an attribute to the `<embed>` tag. It displays a link to the Shockwave download page if browser does not have it.

6.2 Application Requirements

This application was created and tested on the notebook with 1.6 GHz processor, 2 GB (gigabytes) of RAM (Random Access Memory) and ATI X300 with 64 MB (megabytes) of VRAM (video RAM) graphic card. As it is mentioned on Adobe website in system requirements for Adobe Flash Player, the minimum hardware configuration is computer with 450 – 600 MHz processor and 128 MB of RAM [13]. For working with the application is Adobe Flash Player 10.0 needed, that is free for download on internet.

6.3 User Evaluation

For the user feedback it was created the questionnaire to collect information and opinions from users of our application. It was a web page with a final application on the top, then a set of six questions

and an opinion form at the end. All questions had three answers, which were chosen to not take a lot of time to think about. The application contains all three parts, rotation, simulation and manual. There were no restrictions by selecting the respondents. They consist of people of all ages. The count of respondents was 30.

The first question was about graphical design of the whole application. 85% of the respondents answered that they like design of the application. 8% answered that they do not like the application design and the others answered that they like the design partially. From the answers we can see that the style was chosen good and the most of the users like it.

The second question was about the part with the rotation. 92% of the respondents were satisfied with adaptation of this part of application. Nobody was unsatisfied, only 8% were partially. Here we can see the rotation part fulfilled its function.

The third question pertained to the simulation part. 73% answered that they consider the simulation mode of the application good. 8% of the respondents did not like this part and 19% liked this part only partially.

The fourth question detected the users opinions, if the function of the simulator is enough implemented. 78% quizzes answered that yes, 13% no and the rest 9% answered that partially. The most people enlightened their thoughts in comments on the bottom of the questionnaire.

The fifth question determined the opinion of the users' opinion of manual part. 91% answered that the video manual is great idea. Only 4% answered that they do not like it. And 5% liked it partially. From the result of this question we can see that the idea to create video manual instead of the text manual was a good way.

The sixth question was about influence of this application on the bought of this camera. Here first time leads the answer no with 46%. The answer yes had 42%. And 12% of respondents were affected only partially.

The respondents left good and also bad comments at the end of the question form. Mainly the suggestions were about expansion of the functions of the simulation mode of a camera. They like the way the video manual replace the function of the paper manual. Then they like the possibility to try the operation with the camera before a bought.

6.4 Possible Extensions

As it was possible to see in comments from users, the most dominant requirement was the extension of the available functions of a camera. This is, due to open implementation, the easiest extension. It takes only the time to create all the icons and functions to handle it. Because the mechanism of taking photos is designed like in real camera, it is possible in manual exposure modes to simulate the aperture and the priority dependency.

The next idea of practical extension is in creation of the complete framework, at least for cameras from the same manufacturer. There could be use the schema of the layered design of our application. Only the presentation layer should be changed.

Another idea lies in simulation of the photography. There could be created simple two or three dimensional world where could be seen for example different aperture value settings.

6.5 Cons and Pros

The final application and its development have many advantages, but also many disadvantages. According to lot of possibilities of the real camera, not every function had been implemented. Full

operation is available only for simple mode of a camera. There is possibility to take photos, to review them, to delete them, to zoom in and out, to move and to setup values in menu. In other modes we can take photos and zooming. In scene mode is listing available. So as we can see all modes are available, but they are not fully implemented. It should not be problem, because the application is developed to be easily editable. So it is only the matter of time to add the new features.

The following advantages are mainly checkout of a camera before the bought, operating system independence, easy to use clickable environment and accessibility through internet.

And main disadvantages are that the simulation does not contain all functions of a camera and the development is possible only on Windows or Mac OS.

7 Conclusion

Simulator and trainer of the Panasonic FZ7 Camera was discussed in this work. The main goal was to create a program, which could help in teaching in University of the Third Age. There was information about photography. The Adobe Flash with programming language ActionScript was introduced.

The final application consists from three sub applications. The first one is the simple rotation of the camera to give user idea of appearance of a simulated camera. The main one is the simulation, where a user can take pictures and handle operating elements like on real camera. And the last is video manual, which helps user to understand the basics of the camera quicker than with standard printed manual.

The possibilities of extension are wide, from extending the functions of the trainer to the complex simulation of the photography. Due to well designed implementation all mentioned extensions are feasible.

The main contribution of this work is in gaining knowledge about the development on the Flash platform. Next in broaden our horizons in digital photography and user friendly applications. And final contribution in fact, that our application will be used in real life.

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Appendices

Appendix 1. User manual for the created application

Appendix 2. CD with source codes of the created application and application itself

Appendix 1 – User Manual

Introduction

Simulator and trainer of the Panasonic FZ7 camera is the application primary intended for teaching in University of the Third Age. It is created in Adobe Flash with ActionScript programming language. An application consists from three parts – rotation, simulation and video manual of the Panasonic FZ7 camera. This application has graphical user interface. This guide will provide information about features and function of a created application.

System Requirements

The minimum hardware configuration is computer with 450 – 600 MHz processor and 128 MB of RAM. No special video card is needed. The Adobe Flash Player 10.0 is needed.

Running Application

Application starts either by clicking on start.swf or by dragging a start.swf on web browser. The platforms that this application is known to work on include Microsoft Windows, Mac OS, Red Hat, openSUSE, Ubuntu and Solaris. The following web browsers are supported Microsoft Internet Explorer, Firefox, AOL, Safari, Opera and SeaMonkey.

Language Select

The window shown on Figure A1.1 is the first window of the application. On this screen is the language of the application chosen. In this version is English and Slovak language available. Language is chosen by clicking on the flag of desired language. To reselect the language the rerun of the application is needed.

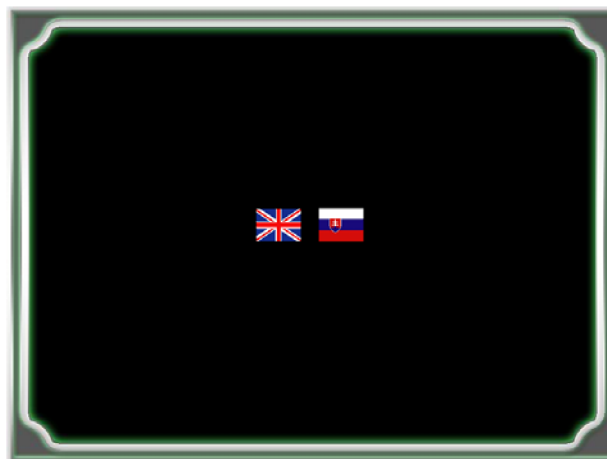


Figure A1.1: Language select

Function Select

After choosing language the window with functions appears. Rotation, simulation and manual mode is available for select. The rotation button leads to part with rotation of the camera. The simulation contains the trainer of the camera. And in manual section are video tutorials. Selection is done by the mouse click on concrete button.



Figure A1.2: Function select

Rotation

In this mode the user can rotate the camera around an axis. To control the rotation mouse dragging or arrow buttons on the screen can be used. For rotation with dragging a mouse button is just simple held down while moving the mouse. For rotation with arrows left or right arrow button (Figure A1.3 number 1) is clicked to spin the camera to the left or to the right. For return to previous screen with mode selection the return button (Figure A1.3 number 2) is clicked.



Figure A1.3: Rotation mode

Simulation

This mode is intended for training with Panasonic FZ7 camera. As it is shown on Figure A1.4 the rear and top view of the camera is available. There are lot of operating elements and these elements are controlled like on a real device, except the mode dial (4) and zooming ring (1). These have blue arrows, which help to control these elements. Other buttons are handled by clicking. The exception is shutter button, which has two states. The first, called press the shutter halfway, is activated by move a mouse over it and the second, representing full press, is available after click.

Fully implemented is only Simple mode, where are all functions of the real camera available. In program, aperture priority, shutter priority, macro modes is taking photos available, but other functions are not available. In scene mode listing through scenes are possible. In movie mode is only icons displayed.

There are two non camera buttons – the info button (2) and the return button. The info button (2) is used to let user inform about current state of the camera and highlight the functional buttons. It shows information, if the mouse is over it. The return button (3) returns to the mode select.



Figure A1.4: Simulation mode

Manual

In this mode are instructional videos included. Each video has its own button (2). To play video the button is needed to be clicked. The video is controlled by standard video buttons (3), which are shown by moving the mouse over the video. These buttons contains play button, stop button, seek bar, mute button and volume bar. The return button (1) has returning function to mode selection screen.



Figure A1.5: Manual mode

Recommendations

Because the web browsers usually store viewed objects into the cache, sometimes it may cause troubles by playing the Flash movie in a browser. So if some problem occurs, first at all a cache memory of browser should be cleared. If there are still problems, version of the Flash Player is the second known problem issue. As it was written before, Adobe Flash Player 10.0 is recommended.