

MAIN CHARACTERISTICS FOR BUILDING AUTOMATED OPHTHALMIC COMPLEXES (AOC)

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Abstract: The requirements and the characteristics for building automated ophthalmic complexes (AOC) are reviewed. Evaluation of the conditions and analysis of the technological order during the design and implementation of the automated ophthalmic complexes are performed. Based on the analysis, instrumentation is proposed for the construction; including project characteristics, model criteria etc. The schematic diagram of the ophthalmic complex is presented.

1. Automated ophthalmic complex as a conglomerate of automated components.

1.1 Elements of the automated complex:

AOC includes the following elements: (Fig. 1 and Fig. 2)

Central component. This component serves as a connecting element to the peripheral components and it is an essential main element of the entire complex.

Peripheral components. These components are axillary. They can be a part of another automated complex and may work in non-real time.

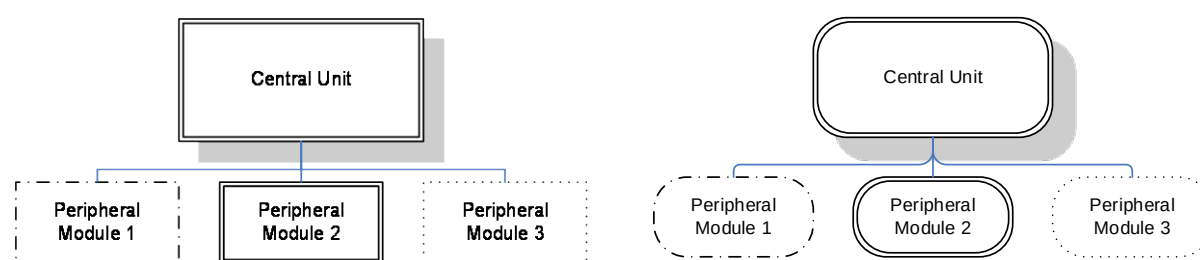


Fig. 1 Elements of the automated medical complex.

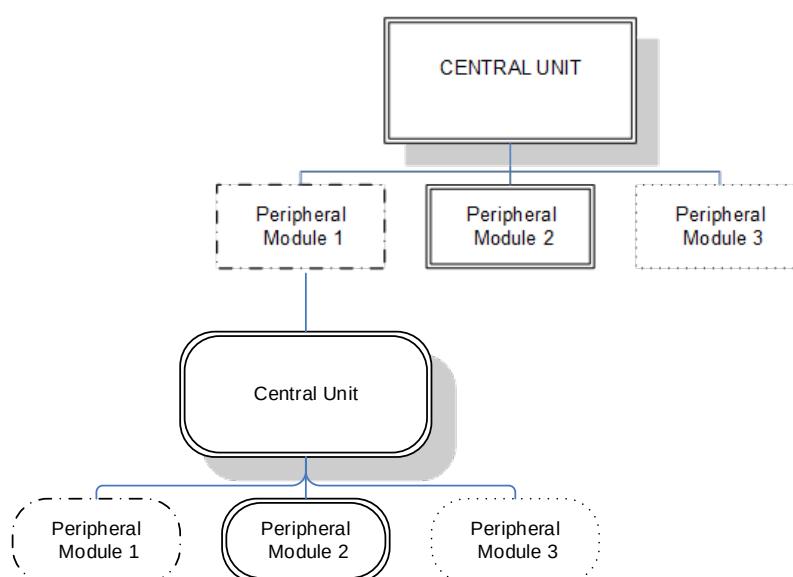


Fig. 2 Composite automated ophthalmic complex

The elements of the automated ophthalmic complex can be viewed as follows:

Central Platform.

It is comprised of ophthalmic microscope. This is the main platform where ophthalmic diagnostic and therapeutic activities are performed. This environment serves as an integral link between the single automated components.

Peripheral components:

- Module for receiving visual information by digitally capturing the eye fundus.

Automatic receiving of retinal digital fundus images.

Automatic digitalization of fundus images captured on film.

- Module for automated transmission of the digital images in real time.

- Module for automatic processing of the visual and real image.

(Automatic extraction of fundus images from video sequence obtained from slit-lamp –fundus bio-microscope.)

- Module for automated display of the processed visual information.

The diagram of the automated and non-automated modules is presented on Fig.3

1.2 Designing of the automated complex.

The order for the design of AOC is:

- Selection of appropriate modules for the automated complex.

- Generation variants of the project.
- Analysis and evaluation of every generated variant and selection of optimal solution.
- Determining the technology of the parts.
- Optimization of the technological process.
- Establishing variants of the automated ophthalmic process.
- Determining the preliminary specifications of the separate modules, nodes and parts.

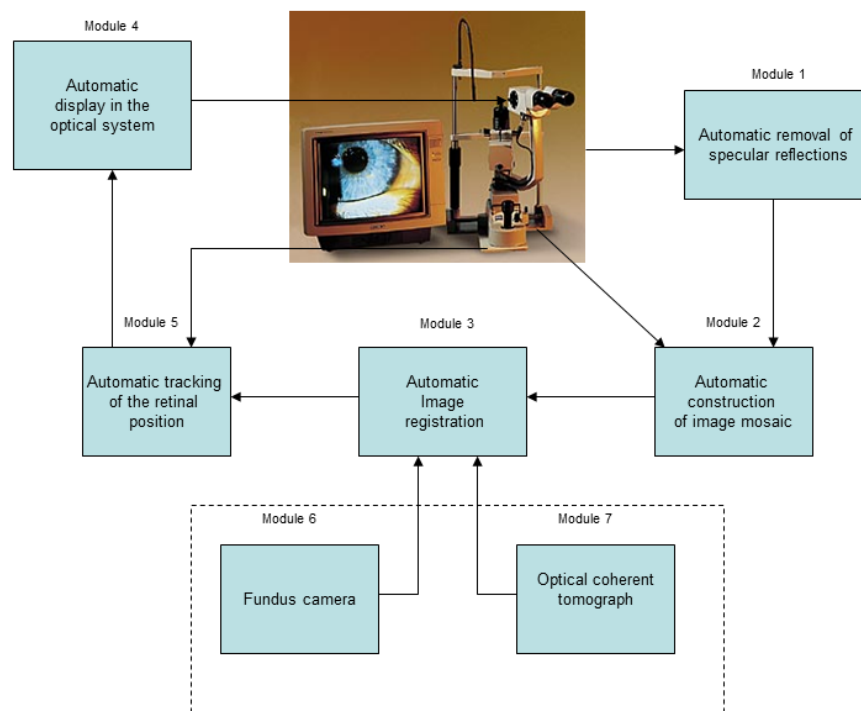


Fig. 3 Schematics of the automated components of the modular complex.

2. Basic elements of the model automated complex

2.1 Elements of the model automated complex and selection criteria.

Biomicroscope (slitlamp, spaltlamp)

Requirements for the bio-microscope with regards to the design for the model automated complex:

To allow adding and incorporation of optical beam splitter.

An important requirement for the ophthalmic microscope when building the model automated ophthalmic complex is to allow adding an optical beam splitter. This requirement is absolutely necessary for the construction of the selected by us model in order to incorporate the methods for “virtual reality”. The two channels for the optical pathway are necessary. One of the channels is fitted with video camera via firm nonflexible connection.

To possess reliable steady manipulation capabilities.

It is connected with the mechanical components for movements of the optical system. In case this requirement is not met the system functions will be impaired due to inability for exact positioning of the optical system and mismatching the velocity of the digital imaging feed.

To be equipped with illuminating system with sufficient brightness.

The brightness of the illumination component should be sufficient to allow adequate visualization of the elements of the ophthalmic fundus not only for the purposes of the clinical observation but also to allow decreasing the thermal noise of the video capturing device.

To permit equipment with laser attachment.

The model ophthalmic complex automates multiple diagnostic routines. It also can be integrated with process of treatment such as laser surgery of the retinal disorders. The laser generator is connected via fibrotic cable to the optical system, which consists of optical elements and mechanical beam manipulator. The attachments are designed specifically for particular bio-microscope model and are not interchangeable.

Ancillary optical system for evaluation of the eye fundus.

The optical configuration of the bio microscope was developed initially for observation of the anterior segments of the eye. An additional hand-held lens is used in front of the bio microscope optics for eye fundus visualization. A contact lens can be used (the lens is placed directly over the eye surface of the patient) or non-contact (the lens is held 10-20mm in front of the eye. Schematic diagram of the AOC is presented in Fig.4

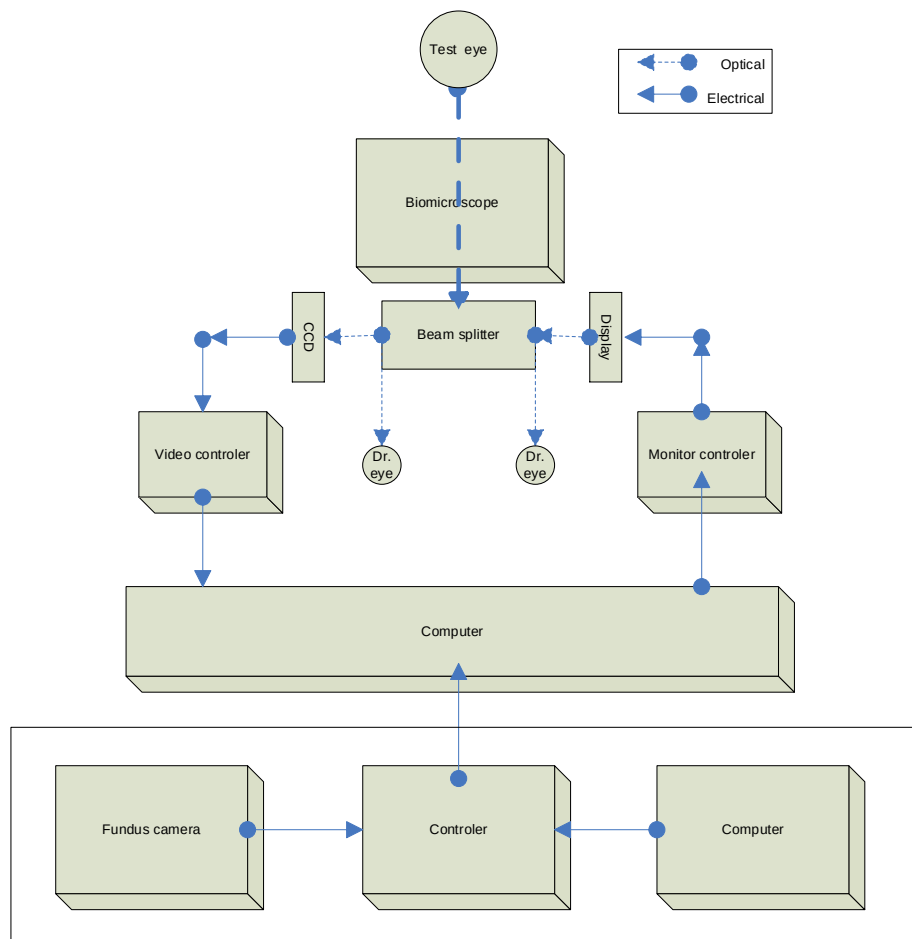


Fig. 4 Schematic diagram of the AOC

Conclusions: Methodology for design of automated ophthalmic complexes is proposed together with the sequence of their construction and expected benefits.

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