

# PORTABLE DISPLAY RECORDING MICROSCOPE

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## Abstract

Many institutions, including high schools, own a large number of analog or ordinary microscopes. These microscopes are used to observe small objects. Unfortunately, object observations on the ordinary microscope require precision and visual acuity of the user. This paper discusses the development of a high-resolution digital microscope from an analog microscope, including the image processing utility, which allows the digital microscope users to capture, store and process the digital images of the object being observed. The proposed microscope is constructed from hardware components that can be easily found in Indonesia. The image processing software is capable of performing brightness adjustment, contrast enhancement, histogram equalization, scaling and cropping. The proposed digital microscope has a maximum magnification of 1600x, and image resolution can be varied from 320x240 pixels up to 2592x1944 pixels. The microscope was tested with various objects with a variety of magnification, and image processing was carried out on the image of the object. The results showed that the digital microscope and its image processing system were capable of enhancing the observed object and other operations in accordance with the user need. The digital microscope has eliminated the need for direct observation by human eye as with the traditional microscope.

**Keywords:** image contrast, digital microscope, image enhancement, image processing

**1. Introduction** Microscope is an instrument to help observing very small objects due to its powerful magnifying capability. Microscope can be used in science and education

[1], evaluation of object's properties [2], medical domain [3], quality control [4], thin films investigation [5] and biomedical analysis [6]. Most microscopes used in India are non digital microscopes. The operation of a compound microscope requires the user to precisely determine the lens combination to get an appropriate level of magnification and focus settings for sharp and clear observation. This is not an easy task for the untrained user and low vision user. These microscopes are used in many hospitals, health agencies and in educational institutions. These microscopes were acquired years ago before digital microscopes are in the market.

In order to enhance the value and the usefulness of a compound microscope, it is proposed to convert the compound microscope into a digital microscope. This is done by attaching an additional hardware to the existing manual microscope which also connects it to an android phone and computer.

The Mobile application is written on an Android phone so that the microscope becomes a digital microscope. The application developed for the digital microscope is basically a digital image processing application. The application is capable of capturing image and carrying out basic image processing tasks

## Material and method



Figure 1 the photographic view of digital display microscope

## 2. The development of the digital microscope

The development of the digital microscope is carried out in two stages, the hardware and software system. The process is discussed in the following sections

### 2.1. The digital microscope hardware

The hardware of the digital microscope consists of an compound microscope, a light source, a camera and the camera. The camera replaces the position of the user's eye.

The image of the observed object is focused on the camera.

The image of the observed object's continuously displayed on the user's mobile screen and computer screen.

The user captures the image of the observed object by selecting the appropriate menu on the computer screen and just touching the capture key on mobile screen

Once the image is captured, it can be stored or process depending on the user need.

### 2.2. The digital display microscope software/application

The digital microscope software consists of camera driver and image processing software. The image processing methods developed for the digital microscope is limited to basic image processing methods and is organized in five units. The image processing units are viewer unit, brightness adjustment unit, image contrast enhancement unit, image scaling unit and image cropping unit.

The digital mobile camera fixed on eyepiece will stream the captured images /videos to another mobile phone for display screen.

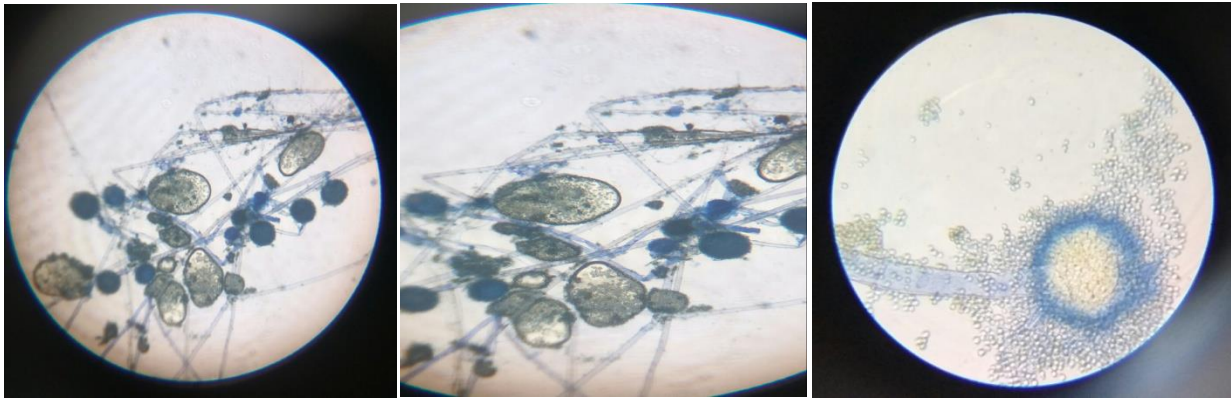
The maximum 30 mobile display screen should be connected to one parent streamer mobile wirelessly

## 3. Results and Analysis

In order to evaluate the usefulness of the proposed digital microscope, a series of test is conducted. The test was designed to cover all aspects of the digital microscope

### Camera quality testing

Figure shows sample images taken for the camera quality testing. In the figures, the image resolution is set to 640x480 pixels. Figure shows three sample objects at the magnification of 500 times. The figure shows that the objects images quality is excellent. The edges of the image are clear and sharp



**Extension activities-** visit to various regional schools and colleges.



### **Advantages of digital microscope-**

To set up digital Microscope is easy. It is portable and can be used any where during night also. The specimen and its details can be observed simultaneously by teacher/demonstrator and students.

Its demonstration for large no. of students becomes easy. The description of specific things in the observable slide can be shown clear and to the point. The digital microscope can be used any where during night, thus helpful in scientific research laboratories. Its low cost made it possible to construct in school laboratories where school goes need to demonstrate the microscopic fields and details by teachers. It is easily used to demonstrate the microscopic objects to large number of students simultaneously

### **Comparison of Digital Microscopes**

Digital microscope is a proven inspection tool for research or product line. Most portable digital microscope device only have objective lens and CCD module and computer to construct whole system . Some digital microscope does not belong to portable inspecting tool while others do. DG-X, developed by Scalar in Japan , and ITRC-001 are examples of

portable digital microscopes. The DG-X microscope is based on all in one CCD module and 3.5 inch LCD panel . the optic performance of our microscope is far beyond the DG-X and ITRC-001. Our microscope and ITRC-001 have build-in dimmable illumination lamp while DG-X does not. However, our microscope is portable

#### 4. Conclusion

A digital microscope developed from an compound microscope (simple, manual microscope) is presented. The microscope has an image resolution ranging from 320x240 pixels up to 2592x1944 pixels. This digital microscope uses a wireless network to communicate with the host android mobile phone and computer etc.

The microscope is equipped with a light source with adjustable intensity.

The digital microscope operates on two modes, a simple mode that do not require software installation, and a normal mode which requires software installation. In simple mode, the microscope can only capture image with resolution of 640 x 480 pixels. In normal mode, the image resolution ranges from 320x240 pixels to 2592x1944 pixels. The image processing software, which was developed for the microscope, can be used to capture, display, and process images. The image processing functions include brightness adjustment, contrast enhancement, histogram equalization, scaling, and cropping.

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**Refrences-** [https://en.m.wikipedia.org/wiki/Digital\\_microscope](https://en.m.wikipedia.org/wiki/Digital_microscope).

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