DEVELOPMENT OF LOW-COST PORTABLE MICROSCOPE (LCPM)

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A thesis submitted in fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (BMMV) with Honours

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2022

DECLARATION

I declare that this Choose an item. entitled “Development of Portable Microscope” is the result of my research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in the candidature of any other degree.

Signature : viisvan

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Date : 06/06/2022

APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor Mechanical Engineering Technology (BMMV) with Honours.

Signature : 

Supervisor Name : KHAIRUL AMRI BIN TOFROWAIH

Date : 11 JAN 2023

DEDICATION

This thesis is dedicated to:

My dearest family, My parents, My supervisor, My lecturers, and all my friends. Thanks for the encouragement and support.

ABSTRACT

Microscopes are one of the most important devices in so many fields. A microscope is usually used for magnifying an object or small living things. It is also important to an entomologist. To help species identification as soon as possible to prevent the mosquitoes from dead for remote fieldwork. A microscope that can bring along with the fellow entomologist to help their species identify the mosquitoes on the exact spot they've obtained them. A portable microscope with some additional features and advantages is the purpose of this study. There are some problems faced by them with the usage of a normal microscope. This project aims to design and fabricate a Low-Cost Portable Microscope (LCPM) develop because it creates a device that can be used by entomologists to overcome problems, they faced by using a normal microscope. By conducting a group survey, analyzing the requirements, and identifying the appropriate design concept using Conceptual Design, the House of Quality (HoQ), and Pugh Method. Furthermore, Solidworks software is used to simulate the Portable Microscope model because it allows for a better understanding of the capabilities of each material. We will be able to reduce costs and create Low-Cost Portable Microscope (LCPM) by selecting the best and durable materials.

ABSTRAK

Mikroskop adalah salah satu alat terpenting dalam banyak bidang. Mikroskop biasanya digunakan untuk membesarkan objek atau benda hidup kecil. Ia juga penting kepada ahli entomologi. Untuk membantu pengecaman spesies secepat mungkin untuk mengelakkan nyamuk mati untuk kerja lapangan jauh. Mikroskop yang boleh membawa bersama rakan ahli entomologi untuk membantu spesies mereka mengenal pasti nyamuk di tempat tepat yang mereka perolehi. Mikroskop mudah alih dengan beberapa ciri dan kelebihan tambahan adalah tujuan kajian ini. Terdapat beberapa masalah yang dihadapi oleh mereka dengan penggunaan mikroskop biasa. Projek ini bertujuan untuk mereka bentuk dan mereka bentuk Mikroskop Mudah Alih Kos Rendah (LCPM) dibangunkan kerana ia mencipta peranti yang boleh digunakan oleh ahli entomologi untuk mengatasi masalah, mereka hadapi dengan menggunakan mikroskop biasa. Dengan menjalankan tinjauan kumpulan, menganalisis keperluan, dan mengenal pasti konsep reka bentuk yang sesuai menggunakan Reka Bentuk Konsep, Rumah Kualiti (HoQ), dan Kaedah Pugh. Tambahan pula, perisian Solidworks digunakan untuk mensimulasikan model Mikroskop Mudah Alih kerana ia membolehkan pemahaman yang lebih baik tentang keupayaan setiap bahan. Kami akan dapat mengurangkan kos dan mencipta Mikroskop Mudah Alih Kos Rendah (LCPM) dengan memilih bahan yang terbaik dan tahan lama.

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To achieve the objective of my project, I have done a lot of research by using the Internet, reading last year's thesis, research papers, books, and journals. With the encouragement that I had and the support given to me, I would like to give credit to those who helped me complete my final year project thesis.

I would want to express my gratitude to my beloved supervisor, TS Khairul Amri bin Tofrawaih, for his direction, patience, wonderful support, inspiration, and understanding throughout this semester of my Final Year Project at Universiti Teknologi Malaysia Melaka (UTeM). His advice was invaluable in assisting me in completing my assignment.

I would also like to dedicate my appreciation to my entire family that always support and guide me with their love. They also gave me a lot of motivation that helped me to finish this project.

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LIST OF SYMBOLS AND ABBREVIATIONS

- LED - Light emitting diode
- BLC - Bare leg catch
- DNA - Deoxyribonucleic acid
- °C - Degree celcius
- PBS - Phosphate Buffered Saline
- UV - Ultraviolet radiation
- TEM - Transmission electron microscope
- SEM - Scanning electron microscope
- USB - Universal serial bus
- RM - Ringgit Malaysia
- 3D - Three dimensional
- HOQ - House of quality
- FDM - Fused deposition modeling
- USAF - United states air force
- FOA - Fiber optic array
- OPM - Oblique plane microscope
- AFM - Atomic force microscope
- AC - Alternating current
- DC - Direct current
- CMOS - Complementary metal oxide semiconductor
- 3T3 - Mouse embryonic fireblast
- nm - Nano meter
- PDMS - Polydimethlysiloxane
- DIH - Digital inline holography
- FOV - Field of view
- MED - Mediterranean
- MEAM - Middle east Asia minor
- PCR - Polymerase chain reaction
- QFD -Quality function deployment
- ITN - Insecticide Treated Net
- RAM - Random access memory
- AMD - Advanced micro device
- SSD - Solid state drive
- kg - kilogram
- LCPM - Low-Cost Portable Microscope

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CHAPTER 1

INTRODUCTION

1.1 Background

The portable microscope is a unique design that is compact and portable. Some are pocketsized, while others are a little bigger. Their size prevents them from holding a mirror and repositioning the picture. They do, however, have a little stage where an object may be shown.

Figure 1.1: Portable microscope (microbite, n.d.)

Portable and pen-sized microscopes with magnifications ranging from 25x to 1000x also utilize batteries and contain an LED light. While some of these microscopes have a focus that can be adjusted. Many tiny microscopes may be used anywhere, including the classroom, and some come with rubberized eyepieces for comfort and safety, particularly when used by young children. Most of these microscopes have no

moving parts and are ideal for introducing youngsters to the hidden world around them. (Microbe Notes , n.d.)

Portable microscopes are extremely useful in the manufacturing industry for detecting flaws in electrical components, metals, optics, glassware, and structural problems in equipment.

Pocket microscopes may be modest in size, but their imaging capacity is not. Some of these portable microscopes weigh only a few ounces and have focus powers comparable to, and in some cases exceed standard microscopes. Natural light and button or normal batteries are used to power pen-sized microscopes. High focal tiny optics used in manufacturing are the size of a standard eyepiece lens and may be driven by electricity. Some smaller hand-held microscopes with computer software allow pictures to be delivered immediately to a printer or computer for processing, or to a laboratory or classroom through electronic transmission from a remote location.

The majority of pocket microscopes feature an eyepiece on one end and a light on the other, as well as a tiny stage where an item may be put for inspection. Some do not have a stage thus the microscope is held at the proper viewing angle above the object. When the design of the microscope includes a mirror and lenses to magnify the image, some pocket microscopes see pictures in reverse. Some pocket microscopes, however, are too tiny to carry a mirror that can orient the picture correctly. (Microscope Master, n.d.)

Pocket microscopes were created so that you could see an object up close no matter where you were. Portable microscopes, as opposed to regular microscopes, may be held in the hand, moved over a big object, and carried in a pocket. Portable and pensized microscopes with magnifications ranging from 25x to 100x also utilize batteries and contain an LED light. While some of these microscopes have a focus

that can be adjusted. Many include computer capabilities, allowing them to observe sections of bigger objects that are too large to fit on a microscope slide by transferring pictures to a computer.

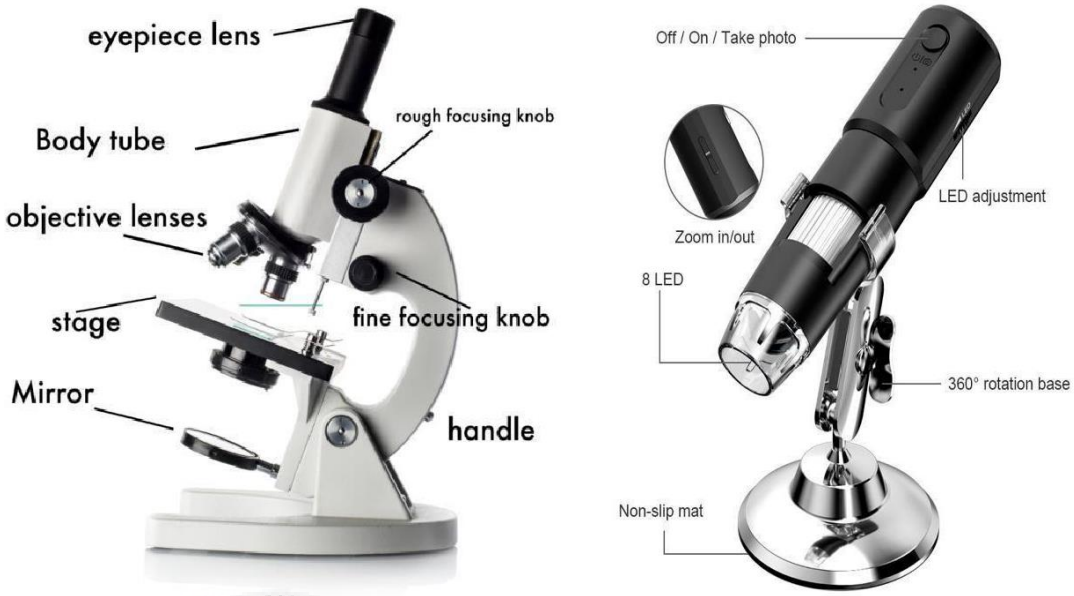

Figure 1.2: Components in Normal Microscope and Portable Microscope (RS Science , n.d.)

1.2 Causes and Effects

Portable microscopes were created so that you could see an object up close no matter where you were. Compare to the normal microscope, a portable microscope is light weighted and able to bring wherever we go. With a portable microscope, we were able to use a microscope on the spot without taking back the sample to the normal microscope that is usually located in the laboratory. Portable microscopes, as opposed to regular microscopes, may be held in the hand, moved over a big object, and carried in a pocket. Portable microscopes provide us with crisp pictures of subjects as tiny as 1 m across a broad field of view with minimum aberrations These tools are

fundamental to contemporary microbiology and a variety of other sciences. Microscopists pioneered the use of polarised light illumination, phase contrast, darkfield imaging, and cameras.

1.3 Method

In this research the species used for this project is mosquitoes. The mosquito, the name originates from Spanish for "little fly," is a kind of insect of the Culicidae family. There are many mosquito species, but one distinctive feature is that the female has a tube-like mouthpart called a proboscis that pierces the skin of the host to suck blood. Female mosquitoes need the resources (mostly vitamins) in blood to lay eggs.

Mosquitoes generally prey on vertebrates such as humans and other mammals, as well as birds, reptiles, and other animals. The majority of species choose people or certain animals as the source of their blood diet. Body scents, carbon dioxide, and heat generated by humans or animals attract them. Most mosquitos prefer to bite at specific times of day, such as dusk or morning.

Different species have different preferences for feeding or resting locations; some prefer natural vegetative habitats, while others prefer urban surroundings, notably rubbish or receptacles in yards. Although the itching can be excruciating, the much more significant concern posed by mosquitos is their capacity to act as vectors, or carriers, for a variety of illnesses such as Zika virus, dengue, West Nile, yellow fever, and malaria, among many others. Certain mosquito species transmit disease-causing

viruses and parasites. Three mosquito genera transmit the most prevalent mosquitoborne illnesses: Anopheles, Aedes, and Culex. (Rent To Kill, n.d.)

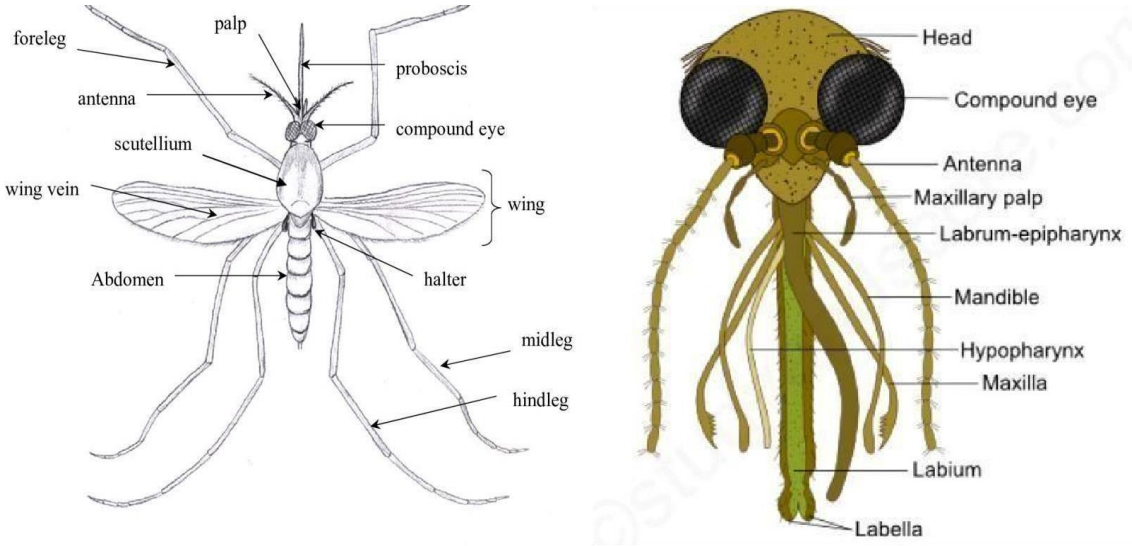

Figure 1.3: body and head parts of a mosquito (ocean county mosquito comission , n.d.)

1.3.1 Bare Leg Catch (BLC)

The bare leg catch (BLC) has long been the gold standard method for monitoring vector populations, including people, they sit with their bottom legs exposed, catching mosquitos that come to feed on them throughout the night. Before sitting Malaria Prophylaxis vaccine is injected from preventing dieses from the mosquito bites.The BLC is a simple, attractive, and efficient instrument. It offers information on the moment of biting and is the most direct measure of mosquito bites. It may be used indoors or outdoors. Data on mosquito bites' time and geographical distribution is critical in many regions where mosquitos attack outside or in the early evening, and it may be even more important in areas where malaria vectors that traditionally feed indoors late at night may be shifting their behaviors in the face of intense pressure from vector control interventions. Moreover, mosquitos are frequently kept alive until handling. This attribute allows a few lab systems that are hard to perform on examples that have been killed or have mid-regions loaded with blood or eggs.

These mosquitos dissected to determine parity as a measure of mosquito age 4-5 or oocyst counts as an indicator of mosquito infection rates. Insecticide resistance tests, which are the direct indicator of the viability of insect poisons utilized for vector control, may also be performed on live mosquitos. Cow bait trap and Ovitrap are among other methods to capture the mosquitoes still BLC is chosen because it's gave fast results and high number of samples within a short period of time.

Figure 1.3.1: Bare leg catch activity at Taman Melaka Baru (pembantu kesihatan awam , n.d.)

1.3.2 Species Identification

The identification of species is critical for ecological monitoring. Species perceptions are utilized to illuminate and assess preservation endeavors such as population trend monitoring, population management plan execution and evaluation, ecosystem health assessments, and extinction analyses.

While specialists identify species in these circumstances regularly, there is also a long record of members of the public submitting identification data to scientific study.