كلية الدراسات العليا

Sudan University of Science and Technology

College of Graduate Studies

Detection of fingerprint using He-Ne (632.8 nm) and Diode (532 nm) lasers

إظهار البصمات باستخدام ليزري الهليوم نيون(632.8nm) والصمام الثنائي (532 nm)

A thesis Submitted as Partial Fulfillment of the Requirements for the Degree of Master of Science in Physics.

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الآية

بسم الله الرحمن الرحيم

قال تعالى:

اللَّهُ نُورُ السَّمَاوَاتِ وَالْأَرْضِ ۚ مَثَلُ نُورِهِ كَمِشْكَاةٍ فِيهَا مِصْبَاحٌ ۖ الْمِصْبَاحُ فِي
زُجَاجَةٍ ۖ الزُّجَاجَةُ كَأَنَّهَا كَوْكَبٌ دُرِّيٌّ يُوقَدُ مِنْ شَجَرَةٍ مُبَارَكَةٍ زَيْتُونَةٍ لَا شَرْقِيَّةٍ وَلَا
غَرْبِيَّةٍ يَكَادُ زَيْتُهَا يُضِيءُ وَلَوْ لَمْ تَمْسَسْهُ نَارٌ ۚ نُورٌ عَلَىٰ نُورٍ ۗ يَهْدِي اللَّهُ لِنُورِهِ مَنْ
يَشَاءُ ۚ وَيَضْرِبُ اللَّهُ الْأَمْثَالَ لِلنَّاسِ ۗ وَاللَّهُ بِكُلِّ شَيْءٍ عَلِيمٌ

سورة النور الآية 35

إهداء

إلى من علمني النجاح والصبر إلى من افتقده في مواجهة الصعاب ولم تمهله الدنيا لأرتوي من حنانه أبي ....

إلى من تتسابق الكلمات لتخرج معبرة عن مكنون ذاتها من علمتني وعانت الصعاب لأصل إلى ما أنا فيه أمي .....

ACKNOWLEDGEMENT

I would like to express my gratitude to my supervisor **Dr.** Ali Abdel Rahman Saeed Marouf for his continuous guidance and advice led to the achievement of my final objectives and my gratitude to all those who have assisted me in completing this work successfully, and much indebted to those who have guided and supported me throughout our work particularly.

Abstract

Fingerprints have many uses, chemical solution usually used to detect fingerprints but it takes a time.

In this research He-Ne laser with output power 1mmW and wavelength 632.8nm and Diode laser with output power 5mmW and wavelength 532 nm were used to detect fingerprints on Aluminum surface and other Glass surface, fingerprints was exposure by laser beam through convex lens with focal length 5mm then a digital camera was used to record irradiated fingerprint.

The revealed results show clear images for the fingerprints using two types of lasers He-Ne and Diode and appearing its characteristics on different surfaces obviously.

Laser method to detect fingerprints is a simple method using low level lasers without chemicals, in short period of time, with low cost and gives good results.

المستخلص

البصمات لها استخدامات عديدة ودائما تستخدم المحاليل الكيميائية في إظهار البصمات ولكنها تستغرق زمن طويل.

في هذا البحث تم استخدام ليزر هيليوم نيون ذو طاقه 1mW وطول موجي 632.8nm وليزر ثنائي ذو طاقه 5mW وطول موجي 532nm لإظهارالبصمات على سطح من الألمونيوم وسطح آخر زجاجي وذلك بسليط أشعة الليزر على البصمة من خلال عدسة مجمعة ذات بعد بؤرري 5mm واستخدام كاميرا رقمية لتصوير البصمة المشععة.

أظهرت النتائج صوراً واضحة للبصمات باستخدام الليزر بنوعيه الهليوم نيون والثنائي وبيان السمات المميزة لها في أسطح مختلفة بدرجة واضحة.

الطريقة الليزرية لإظهار البصمات طريقة بسيطة بواسطة ليزرات ذات قدرة منخفضة بدون استخدام مواد كيميائية في فترة زمنية صغيررة وبأقل تكلفة وتؤدي إلى نتائج جيدة.

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Chapter One

Introduction

1-1 introduction

Laser is a device that issue of light through optical amplification process based on stimulated emission of electromagnetic radiation laser differs from other light sources as a coherent light and has a high intensity and with directional is available. Many types of lasers such as gas lasers and semiconductor chemical lasers .It can insert in many applications several among many applications, the use of lasers in optical disk drives, laser printers and engines, barcode scanners and fiber optic in a free-space optical communication , Laser surgery and skin treatment, Cutting and welding materials; military and law enforcement agencies to identify goals and measure their speed. And laser lighting displays in the field of entertainment DNA sequencing tools, used to detect fingerprints.

Fingerprint Identification is the method of identification using the impressions made by the minute ridge formations or patterns found on the fingertips. No two persons have exactly the same arrangement of ridge patterns, and the patterns of any one individual remain unchanged throughout life. Fingerprints offer an infallible means of personal identification. Other personal characteristics may change, but fingerprints do not. change

1-2 Research problem:

Using of conventional methods to detect fingerprint is take long time to give result, there for another technique is required in order decrease time duration. Also conventional method is complicated so and simple method is required; and this research focuses on detecting fingerprint using two types of laser.

1-3 Literature review

In October 2, 2001 E. Roland Menzel, focused on lanthanide chelates, nanocrystals, and nanocomposites functionalized to label fingerprints. Photoluminescence detection of latent fingerprints has over the last quarter century brought about a new level of fingerprint detection sensitivity. The current state of the art is briefly reviewed to set the stage for upcoming new fingerprint processing strategies. These are designed for suppression of background fluorescence from articles holding latent prints, an often serious problem. The suppression of the background involves time-resolved imaging, which is dealt with from the perspective of instrumentation as well as the design of fingerprint treatment strategies.

In 2006 M. T. TASCHUK *et al* demonstrated detection of latent fingerprints on a Si wafer by laser-induced breakdown spectroscopy (LIBS) using approximately 120 fs pulses at 400 nm with energies of 84 (+ or -)7μJ. The presence of a fingerprint ridge is found by observing the Na emission lines from the transferred skin oil. The presence of the thin layer of transferred oil was also found to be sufficient to suppress the LIBS signal from the Si substrate, giving an alternative method of mapping the latent fingerprint using the Si emission. A two-dimensional image of a latent fingerprint can be successfully collected using these techniques. (In 2009 Jianjiang Feng *et al* tried to understand the problem of altered fingerprints and to design solutions that can be used to detect these images. In this regard, this paper makes following contributions: (a) compiling case studies of incidents where individuals were found to have altered their fingerprints for circumventing fingerprint systems; (b) classifying the observed alterations into three broad categories and suggesting possible counter-measures; (c) a method to synthetically generate altered fingerprints in the absence of real-world data; (d) a technique to detect altered fingerprints; and (e) experimental results involving both real-world altered prints and synthetically generated altered prints. Experimental results show the feasibility of the proposed approach in detecting altered fingerprints and highlight the need to further pursue this research agenda.

In 2011Abdelwahed motwakel *et al* In his paper used the preprocessing method improve image quality appropriately ,by applies several steps on the dry fingerprint image, smoothing skeltonization , dilation , and the union of black pixels in the original image and dilated image. experimental result indicate that the preprocessing method improve the quality of the dry fingerprint images significantly .

1-4 Objectives

The aim of this study is to:

Detect fingerprint by laser.

Compare between results of using two types of visible lasers.

Study laser mater interactions.

1-5 Layout of thesis:

In this research chapter one views the introduction, research problem, literature review, objectives and thesis layout. Chapter two Theoretical Background, chapter three experimental port and results, discussion, conclusion and recommendation in chapter four, finally list of references.

Chapter Two

Theoretical Background

2-1 Laser

2-1-1 Introduction

The term “laser” is an acronym for (light amplification by stimulated emission of radiation). Lasers are devices that produce intense beams of light which are *monochromatic*, *coherent*, and *highly collimated*. The wavelength (color) of laser light is extremely pure (monochromatic) when compared to other sources of light, and all of the photons (energy) that make up the laser beam have a fixed phase relationship (coherence) with respect to one another. Light from a laser typically has very low divergence. It can travel over great distances or can be focused to a very small spot with a brightness which exceeds that of the sun. Because of these properties, lasers are used in a wide variety of applications in all walks of life

2-1-2 Properties of laser

The typical properties of laser light make the laser an ideal device for many physical and technical applications. Let us quote some of its most important properties.

(I) Laser light can have high intensities. Within laser light pulses, powers far greater than 10" w can be achieved. In order to visualize this power just think that 10' light bulbs, each with 100 W, are needed to produce the same power. It is more than the power of all American power stations taken together. For applications in laser fusion, lasers with the power of more than 10" W are built or tested experimentally at present. High cw emission can also be achieved. It reaches an order of magnitude of about lo5 W. The achieved top powers are not published (for obvious reasons).

(2) Laser light possesses a high directionality. This stems from the fact that the light within the laser hits the mirrors at its end faces in form of a plane wave, whereby the mirrors act as a hole giving rise to diffraction (fig. 2.1). In this way the ideal divergence of a plane wave diffracted by a slit is closely approached. A laser with a diameter of a few centimeters can give rise to a laser beam which, when directed to the moon, gives rise to a spot of a few hundred meters in diameter. The strict parallelism of the emerging light results in an excellent focusability which jointly with the high laser light intensity allows a production of very high light intensities in very small volume elements. When one calculates the electric field strength belonging to the corresponding light intensity, field strengths result which are far bigger than 10' V/cm. These are field strengths to which otherwise electrons in atoms are subjected. In this way ionization of atoms by means of laser light becomes possible

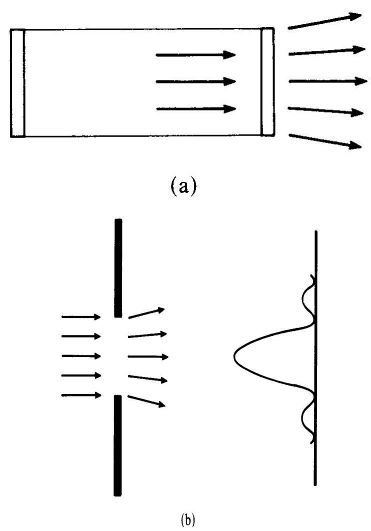


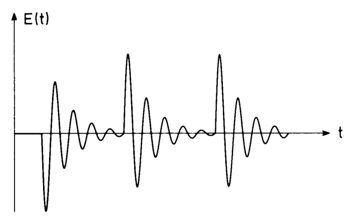
Fig. 2.1. By means of the laser process a plane parallel wave is produced in the laser (a). The divergence of the emitted beam corresponds to that of a plane wave diffracted by a slit (b).

(3) The spectral purity of laser light can be extremely high. The frequency width which is inversely proportional to the emitted power can be ***Sv*** = 1 ***HZ*** for 1 W emitted power in the ideal case. Experimentally ***6v*** = 100 ***Hz*** has been realized. Taking ***Sv*** = 1, the relative frequency width for visible light is ***Sv/v*** = 10-l5 which is of the same order of magnitude as that of the Mossbauer effect. It is

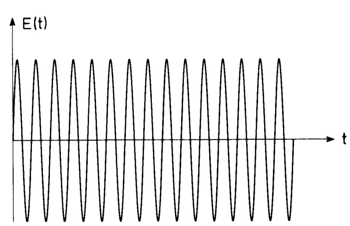
important to note that this frequency purity is achieved jointly with a high intensity of the emitted line quite in contrast to spectrographs where high frequency purity is achieved at the expense of intensity. The frequency purity of laser light is closely connected with its coherence (see point (4)).

(4) Coherence. While light of usual lamps consists of individual random wave tracks of a few meters length, laser light wave tracks may have a length of 300,000 km.

(5) Laser light can be produced in form of ultrashort pulses of 10-l2 s duration (picoseconds) or still shorter, e.g. 30 femtoseconds (1 femtosecond = lo-' s). Quite evidently the properties of laser light just mentioned make the laser an ideal device for many purposes which we shall explore in the present



(a)



(b)

Fig. 2.2. (a) The electric field strength E *(t)* of light of a lamp consists of uncorrelated individual wave tracks. (b) Laser light consists of a single coherent very long wave track. (haken, 2000)

2-1-3Types of Lasers

Laser types are identified by their lasing media (which determines the wavelength). Some media can produce more than one wavelength.

Solid state: is an optically clear material composed of a crystal and an impurity dopant. The output wavelength is determined for the most part by the impurity. Examples: Ruby laser, Nd:YAG.5

Gas**:** are very much like fluorescent light sources. An electric current passes through the optical cavity exciting atoms, resulting in the emission of light. Examples: CO2, HeNe, Ar, XeCl, excimer lasers.

Liquid (Dye): have a flowing dye and are usually pumped by a flash lamp or another laser. They can be operated either as pulsed or CW and are wavelength tunable. They tend, however, to be complex systems with demanding maintenance.

Semiconductor**:** is perhaps the most common laser used currently with output wavelengths in the 750 to 950 nm range (commonly used in CDs and CD/ROM players) or the 1100 to 1650 nm range (used in optical communications). Example: GaAlAs, InGaAsP.

Free Electron Lasers (FELs)**:** function via an electron beam in the optical cavity which passes through a wiggler magnetic field. The generated wavelengths are in the microwave and x-ray region. (drewsen, 2002)

Table 2.1 Table 1 Wavelengths of Common Lasers

Laser Type	**Media**	**Spectral range**	**Wave Length**
Excimer Gas Lasers	Argon Fluoride	UV	193nm
	Krypton Chloride	UV	222nm
	Krypton Fluoride	UV	248nm
	Xenon Chloride	UV	308nm
	Xenon Fluoride	UV	351nm
Gas Lasers	Xenon Fluoride	UV	337nm
	Helim Cadmium	UV	325nm
	Helium Cadmium	Violet	441nm
	Argon	Blue	488nm
	Argon	Green	514nm
	Krypton	Blue	476nm
	Krypton	Green	528nm
	Krypton	Yellow	568nm

	Krypton	Red	647nm
	Xenon	White	Multiple
	Helium Neon	Green	543nm
	Helium Neon	Yellow	490nm
	Helium Neon	Orange	612nm
	Helium Neon	Red	633nm
	Helium Neon	NIR	1.152nm
	Helium Neon	MIR	3.390nm
	Hydrogen Fluoride	MIR	2.700nm
	Carbon Dioxide	FIR	10.600nm
Metal Vapor Lasers	Copper Vapor	Green	510nm
	Copper Vapor	Yellow	570nm
	Gold Vapor	Red	627nm
	Doubled Nd:YAG	Green	532nm
	Neodymium: YAG	NIR	1.064nm
	Erbium: Glass	MIR	1.540nm
	Erbium: YAG	MIR	2.940nm
	Holmium: YLF	MIR	2.060nm
	Holmium: YAG	MIR	2.100nm
	Chromium Sapphire (Ruby)	Red	694nm
	Titanium Sapphire	NIR	(840-1.100)nm
	Alexandrite	NIR	(700-815)nm
Dye Lasers	Rhodamine 6G	VIS	(570-650)nm
	Coumarin C30	Green	504nm
Semiconductor Lasers	Galium Arsenide (GaAs)	NIR	840nm
	Galium Aluminum Arsenide	VIS/NIR	(670-830)nm

(Barat, 2007)

2-1-4 Laser Applications

Medical Uses of Lasers: The highly collimated beam of a laser can be further focused to a microscopic dot of extremely high energy density. This makes it useful as a cutting and cauterizing instrument. Lasers are used for photocoagulation of the retina to halt retinal hemorrhaging and for the tacking of retinal tears. Higher power lasers are used after cataract surgery if the supportive membrane surrounding the implanted lens becomes milky. Photodisruption of the membrane often can cause it to draw back like a shade, almost instantly restoring vision. A focused laser can act as an extremely sharp scalpel for delicate surgery, cauterizing as it cuts. ("Cauterizing" refers to long-standing medical practices of using a hot instrument or a high frequency electrical probe to singe the tissue around an incision, sealing off tiny blood vessels to stop bleeding.) The cauterizing action is particularly important for surgical procedures in blood-rich tissue such as the liver.

Welding and Cutting: The highly collimated beam of a laser can be further focused to a microscopic dot of extremely high energy density for welding and cutting. The automobile industry makes extensive use of carbon dioxide lasers with powers up to several kilowatts for computer controlled welding on auto assembly lines.

Garmire points out an interesting application of CO_2 lasers to the welding of stainless steel handles on copper cooking pots. A nearly impossible task for conventional welding because of the great difference in thermal conductivities between stainless steel and copper, it is done so quickly by the laser that the thermal conductivities are irrelevant.

Surveying and Ranging: Helium-neon and semiconductor lasers have become standard parts of the field surveyor's equipment. A fast laser pulse is sent to a corner reflector at the point to be measured and the time of reflection is measured to get the distance.

Some such surveying is long distance! The Apollo 11 and Apollo 14 astronauts put corner reflectors on the surface of the Moon for determination of the Earth-Moon distance. A powerful laser pulse from the MacDonald Observatory in Texas had spread to about a 3 km radius by the time it got to the Moon, but the reflection was strong enough to be detected. We now know the range from the Moon to Texas within about 15 cm, a nine significant digit measurement. A pulsed ruby laser was used for this measurement

Lasers in the Garment Industry: Laser cutters are credited with keeping the U.S. garment industry competitive in the world market. Computer controlled laser garment cutters can be programmed to cut out 400 size and then 700 size garments - and that might involve just a few cuts. The programmed cutter can cut dozens to hundreds of thicknesses of cloth, and can cut out every piece of the garment in a single run.

The usefulness of the laser for such cutting operations comes from the fact that the beam is highly collimated and can be further focused to a microscopic dot of extremely high energy density for cutting.

Lasers in Communication: Fiber optic cables are a major mode of communication partly because multiple signals can be sent with high quality and low loss by light propagating along the fibers. The light signals can be modulated with the information to be sent by either light emitting diodes or lasers. The lasers have significant advantages because they are more nearly monochromatic and this allows the pulse shape to be maintained better over long distances. If a better pulse shape can be maintained, then the communication can be sent at higher rates without overlap of the pulses. Ohanian quotes a factor of 10 advantages for the laser modulators.

Telephone fiber drivers may be solid state lasers the size of a grain of sand and consume a power of only half a milliwatt. Yet they can sent 50 million pulses per second into an attached telephone fiber and encode over 600 simultaneous telephone conversations (Ohanian)

Heat Treatment: Heat treatments for hardening or annealing have been long practiced in metallurgy. But lasers offer some new possibilities for selective heat treatments of metal parts. For example, lasers can provide localized heat treatments such as the hardening of the surfaces of automobile camshafts. These shafts are manufactured to high precision, and if the entire camshaft is heat treated, some warping will inevitably occur. But the working surfaces of the cams can be heated quickly with a carbon dioxide laser and hardened without appreciably affecting the remainder of the shaft, preserving the precision of manufacture.

Barcode Scanners: Supermarket scanners typically use helium-neon lasers to scan the universal barcodes to identify products. The laser beam bounces off a rotating mirror and scans the code, sending a modulated beam to a light detector and then to a computer which has the product information stored. Semiconductor lasers can also be used for this purpose. (Nave, 2012)

2.2 Fingerprint

2.2.1 Fingerprints defenition

Is prominent protrusions in skin complexion neighboring depressions, and everyone has a distinctive form, has proven that it cannot match the fingerprint that is similar in the two people in the world, even identical twins, which originated from a single egg, and these lines have an impact on everybody touch and smooth surfaces in particular.

The imprint of a fingerprint consists of natural secretions of the sweat glands that are present in the friction ridge of the skin (Figure 2-3). These secretions are a combination of mainly water, oils, and salts. Dirt from everyday activities is also mixed into these secretions. Anytime you touch something, you leave behind traces of these substances in the unique pattern of your dermal ridges.

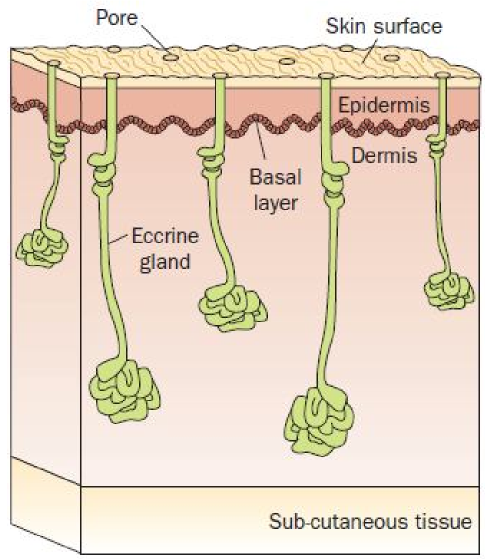


Figure 2.3 Our fingertips

Figure (2-3) our fingertips are covered with hundreds of microscopic sweat pores, which make our fingers moist and able to grip better.

(J.bertion, 2008)

2.2.2 Characteristics of fingerprint

There are 3 general fingerprint distinctions:

(a) (b) (c)

Fig 2-4

Fig 2-4 (a) type Rach fingerprint about 5% of the population and (b) type whorl fingerprint about 30% of the population and (c) type loop fingerprint about 65% of the population

They are named for their general visual appearance and patterns,called loops, whorls, and arches.

Arches (5% of the population has this type): Have ridges that enter from one side of the fingerprint and leave from the other side with a rise in the center.

Whorls (30% of the population has this type): Look like a bull's-eye with two deltas (triangles).

Loops (65 % of the population has this type): Enter from either the right or the left and exit from the same side they enter.

Basic patterns can be further divided: Arch patterns can be plain (4%) or tented (1%). Whorl patterns can be a plain whorl (24%) a central pocket loop whorl (2%), double loop whorl (4%), or accidental (0.01%).

Even twins have unique fingerprints due to small differences (called *minutiae*) in the ridge patterns.

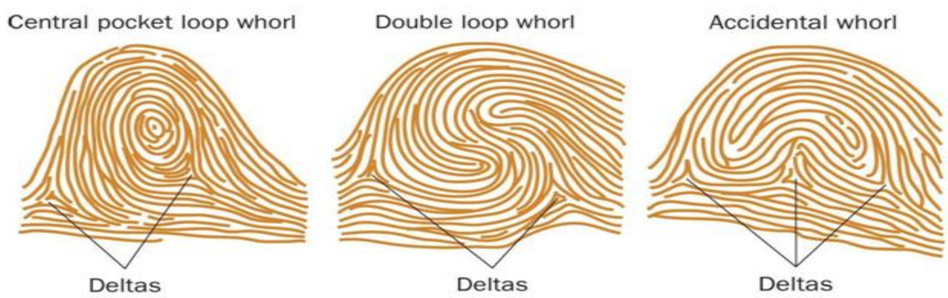


Figure 2.5 Characteristics of fingerprint

2.2.3 Types of fingerprint

Patent prints - are visible prints that occur when a foreign substance on the skin of a finger comes in contact with the smooth surface of another object. These prints leave a distinct ridge impression that is visible with the naked eye without technological enhancement of any kind. The tried and true "blood on his hands" evidence is an example of patent prints recovered from a crime scene or scene of interest to investigators. These foreign substances contain dust particles which adhere to the ridges of the fingers and are easily identifiable when left on an object.

Plastic prints - are visible, impressed prints that occur when a finger touches a soft, malleable surface resulting in an indentation. Some surfaces that may contain this type of fingerprint are those that are freshly painted or coated, or those that contain wax, gum, blood or any other substance that will soften when hand held and then retain the finger ridge impressions. These prints require no enhancement in order to be viewed, because they are impressed onto an object and are easily observable.

Latent prints - are fingerprint impressions secreted in a surface or an object and are usually invisible to the naked eye. These prints are the result of perspiration which is derived from sweat pores found in the ridges of fingers. When fingers touch other body parts, moisture, oil and grease adhere to the ridges so that when the fingers touch an object, such as a lamp, a film of these substances may be transferred to that object. The impression left on the object leaves a distinct outline of the ridges of that finger. These fingerprints must be enhanced upon collection and, because they serve as a means of identifying the source of the print, they have proven to be extremely valuable over the years in the identification of its source.

(Gutenberg, 2017)

2.2.4 Ridge Characteristics

Fingerprints also have minutiae points, which are points where the ridge structure changes. These are useful in matching a fingerprint to a spe

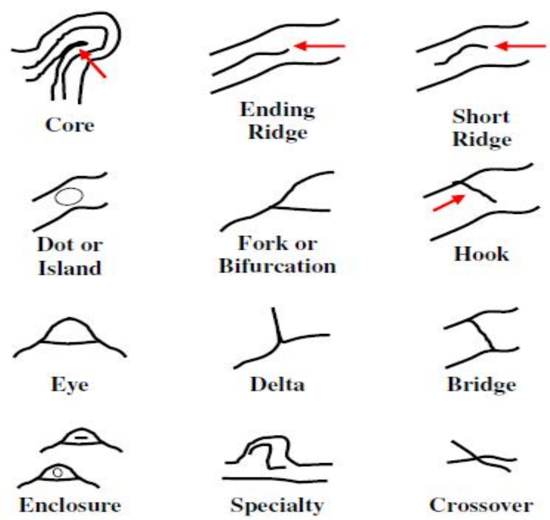


Figure 2-6 ridge characteristics

2.2.5 Detection methods of fingerprinting

Physical methods: This section will discuss, briefly, physical methods of fingerprint development in the sequence of solid, liquid, and vapor procedures

Crystal Violet Fingerprints on the sticky side of adhesive tapes are most commonly developed by staining with crystal violet (Gentian violet). A typical formulation involves dissolving 0.15 g of the dye in 10 ml of ethanol and adding this to 500 ml of distilled water. The tape to be examined is floated on the solution sticky side down, or is immersed. On black electrical tape, the contrast between the developed print and the substrate is poor. However, the print may be transferred to a white substrate, in a manner analogous to the lifting of dusted prints via trans-parent lifting tape.

Physical Developer this process ultimately has as its origin the silver halide photographic process, which dates back to the late 19th century. In the final analysis, it amounts to the preferential adherence of siver particles of colloidal dimensions to lipid material of the fingerprint residue. The essence of the physical developer solution involves oxidation/reduction to form, from silver nitrate, in which the silver is present in the form of the monovalent action (Ag^+), the colloidal particles of neutral silver metal. A surfactant is present in the treatment to maintain the colloidal silver particles in suspension. An article to be examined is immersed in the working solutions, namely a pre-wash solution that contains maleic acid and then the working colloidal silver solution, which is made up, in turn, of a redox solution, a surfactant solution, and a silver nitrate solution

Multi-Metal Development this procedure is a modification of physical developer in which a colloidal gold solution treatment precedes the physical developer step. The colloidal gold attaches to amino acids, peptides and proteins of the fingerprint residue and forms nucleation sites for the subsequent deposition of the silver. Thus, both lipids and these other fingerprint constituents are probed

Silver Nitrate this fingerprint detection method, which dates back to the late 19th century, is by rights to be considered a chemical one. However, given the similarity be-tween it and the physical developer, it is presented at this juncture. In essence, the method is silver halide photography. Silver nitrate, in the presence of Chloe-ride anions of the salt in fingerprint residue, forms silver chloride. This basically is the displacement of the nitrate anion by the chloride anion. Subsequent expo-sure to light reduces the silver action to neutral silver, which results in a dark grey (basically black) fingerprint development. Silver nitrate fingerprint detection is no longer used as commonly as it once was, due to the expense of the reagent, cumbersome procedure, and background darkening, i.e., poor selective development of the print. Silver nitrate development is not very effective on articles that have been exposed to high humidity or that have become wet, be-cause of the water solubility of salt.

Iodine Fuming Let us suppose we place into a closed container an article holding a fingerprint together with iodine crystals. The iodine crystals will undergo sublimation, hence the formation of iodine vapor (which can be accelerated by mild heating of the crystals). The iodine vapor molecules preferentially attach to fingerprint. Material, to yield yellowish brown fingerprint marks. Thus; the developed marks are rather fugitive. Once the article is removed from the container, and is no longer in the presence of high vapor pressure iodine vapor, iodine molecules detach from the print, which quickly fades. This can be remedied to some extent by fixing with benzoflavone

Today iodine fuming is no longer used frequently. However, as is the case with many vapor development procedures, there is the virtue of delicacy, i.e., the prospect of fingerprint detection on articles that may not be amenable to dusting or to procedures that involve solvents (liquid development).

Metal Evaporation let us suppose we place an article to be examined, typically one with a smooth Surface, mostly plastic, into a vacuum chamber and we evaporate a metal (from a heated boat) onto the article: The metal thus deposited, when properly chosen, will preferentially deposit either on the fingerprint or will preferentially avoid

The fingerprint. Either way, the reflection, by the deposited metal, of light from the article subsequently examined in room light will reveal the fingerprint. This is the basic principle of the metal deposition procedure of latent fingerprint development. Unlike the earlier—discussed procedures, we have an instrumentation intensive approach, one that requires a vacuum chamber, and the metal evaporation machinery in it. Typically, the evaporation is a two-step procedure which first involves the evaporation of gold. This sounds expensive, but is not, in that the amount of gold required is small. The gold deposited serves as a nucleation site for the subsequent deposition of a second metal (which is cheaper). Typically cadmium or Zinc are used, preferably the latter because of the reduced health risk. The metal deposition method is a restricted one in that it pertains only to certain kinds of surfaces, mostly plastics such as polyethylene, and because the size of the article amenable to examination is limited by the size of the available vacuum chamber. Because vacuum and metal evaporation techniques pertain, the method requires more technical expertise than what is involved in, for instance, dusting.

Autoradiography this procedure for fingerprint detection involves the use of radioactive material.

As such, to the author’s knowledge, it is a procedure that is not routinely used anywhere. Its use involves licensing and, obviously, elaborates precautions for the confinement and disposal of radioactive material. Nonetheless, the methodology is cited here because it shows prospects for fingerprint detection on other-wise intractable items. Let us confine our attention to the approach that involves vapor development using radioactive sulfur dioxide (namely radioactive sulfur-35). Vapor methods, by virtue of their delicacy, over dusting. Approaches, lend themselves to the processing of obnoxious items, such as cloth, for instance. Sulfur dioxide molecules preferentially adhere to fingerprint material. X ray film is subsequently pressed against the article that has been exposed to the sulfur dioxide vapor, and an image of the fingerprint is obtained through exposure of the film as a result of the radioactive decay of the sulfur. Often, the film exposure is hours, if not days. In this respect, we are reminded of DN profiling, in which similar radioactive tagging pertains, similarly time-con-summing (Menzel, 1999)

Cyanoacrylate: Investigators often perform cyanoacrylate (superglue) processing, or fuming, of a surface before applying powders or dye stains. This process, typically performed on non-porous surfaces, involves exposing the object to cyanoacrylate vapors. The vapors (fumes) will adhere to any prints present on the object allowing them to be viewed with oblique ambient light or a white light source. (Menzel, 1999)

Chemical method

Porous surfaces such as paper are typically processed with chemicals, including ninhydrin and physical developer, to reveal latent fingerprints. These chemicals react with specific components of latent print residue, such as amino acids and inorganic salts. Ninhydrin causes prints to turn a purple color, which makes them easily photographed

Alternate Light Source (ALS): It is becoming more commonplace for investigators to examine any likely surfaces (doors, doorknobs, windows, railings, etc.) with an alternate light source. These are laser or LED devices that emit a particular wavelength, or spectrum, of light. Some devices have different filters to provide a variety of spectra that can be photographed or further processed with powders or dye stains. For example, investigators may use a blue light with an orange filter to find latent prints on desks, chairs, computer equipment or other objects at the scene of a break-in

(Nfstc , 2013)

BIOLOGICAL METHODS is hiyama and co-workers reported in 1977 on a procedure for ABO blood group typing of fingerprint residue. Okada and Ohuri similarly utilized anti-A and anti-B antisea, and anti-H lectins and showed the feasibility of thus revealing the presence of fingerprints. Hussain and Pounds reported on a mixed ag-glutination reaction for the detection of fingerprints on various substrates and evaluated a number of antibodies and lectins for fingerprint work. Bacterio-logical approaches to the detection of fingerprints were investigated by Harper and co-workers. The combination of fingerprint detection and DNA profil-ing was reported by Oorschot and Jones. This latter work is not directly concerned with fingerprint detection, but it elucidates the emerging interplay between chemical and biological facets of the field. While none of the above studies have so far led to any routine implementation in the fingerprint commu-nity, one must surely anticipate that this will change, given the vigorous evolu-tion of biochemical/biomedical methodology in recent years. Indeed, the antici-pation is that the next century will be the century of bioscience. In this connection, note that there has been recent renewed interest in examining the composition of fingerprint residue (menzel, 1999).

2.3 Laser Mater Interaction

Lasers have opened new fields of investigation in science and technology. It has given physics a versatile tool for the study of interaction of light and matter. The powerful beam of laser has become an important tool for spectroscopic analysis. A laser system, known as microprobe, is used for exciting emission from solid samples for spectrographic analysis. In 1928, Prof. CV Raman discovered a new phenomenon, known as Raman Effect. by which molecular structures of different substances can be investigated by passing monochromatic light through them. He found that when light passes through a transparent substance, it is scattered and emerges with a change of frequency caused due to the vibration of molecules in the substance. This produces additional lines (known as Raman lines) in the scattered light spectrum. The discovery of laser is a great boon for recording the Raman spectra. The use of lasers has enabled recording of Raman lines within seconds, which otherwise would require long exposure times of or few hours using ordinary light sources. The analysis of Raman lines gives the fundamental properties of the substances. Similarly, lasers can also be used for analyzing liquids. A laser beam, when passed through a liquid, gives several colures (wavelengths) and the process is called fluorescence. The study of the fluorescence spectra thus obtained gives the properties of the liquids. Lasers offer attractive possibilities in terms of the exploration of molecular structure and determination of nature of chemical reactions. A laser beam can initiate and hasten a chemical reaction. Since different reactions require different wavelengths of light, a 'tunable' laser (i.e., a source whose wavelength can be altered as in radio tuning) is of immense help to a chemist. Tunable lasers, particularly dye lasers, now cover the entire visible spectrum and have revolutionized optical spectroscopy. In photochemistry, lasers with short duration pulses are highly useful for inducing and monitoring ultrafast chemical reactions more efficiently than by any conventional method. Laser also finds application in biological research. Using laser techniques, biological studies have been carried out in enzymes, proteins, cellular components and isolated cells, microorganisms, tissue culture, isolated physiological systems individual organs, etc. Using a ruby laser coupled with a microscope, single cells have been irradiated with laser beams focused on to a spot of the order of one micron to destroy individual chromosomes, thus making available a highly delicate instrument for genetic studies. It is also possible to produce laser beams as narrow as the diameter of a protein molecule and use it to alter genetic properties of living organisms (Bretenaker, 2015)

Chapter Three

Experimental part

3.1 materials and method part

The propos at the research we use different material with different properties and we were shown all these properties of material below

3.1.1 Laser sources

The first laser was Helium-Neon laser (He-Ne) with wave length 632.8 nm and output power 1 mW, Figure 3.1.

Figure 3.1 He-Ne laser

The second one was green diode laser pointer with wave length 532nm and output power 5 mW, Figure 3.2.

Figure 3.2 Diode laser

3.1.2 Lens

Convexes lens with focal lens 5mm was used to focuses the photoluminescence of the laser on the surface, Figure 3.3.

Figure 3.3 lens

3.1.3 Camera

Not 3 Phone camera with prices 13mp were used to photo the fingerprint, Figure 3.4.

Figure 3.4 Not3 phone

3.1.4 Sample

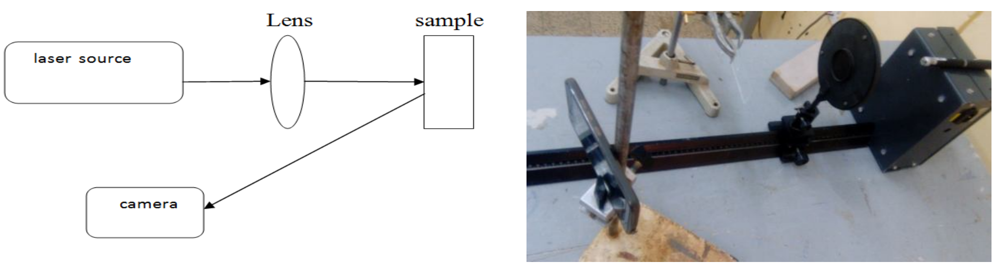
Different surfaces were used to detect the fingerprint, first sample is aluminum knife with soft surface, the second surfaces was microscopic slides with clear glass and thick 1.0mm-1.2mm (25*75mm) Figures 3.5 and 3.6.

Figure 3.5 V aluminum knife

Figure 3.6 microscopic slides

3.2 Methodology

Laser beam shed with different power through convex lens, with focal length 5mm on surfaces different contain fingerprint using two types of lasers, diode laser with wavelength 532nm and output power 5 mW and He-Ne laser with wave length 632.8nm and output power 1 mW which led to show the fingerprint and take photo of this fingerprint by camera, Figure 3.7.



(a) (b)

Figure 3.7 Experimental setup; a) schematic diagram b) photograph

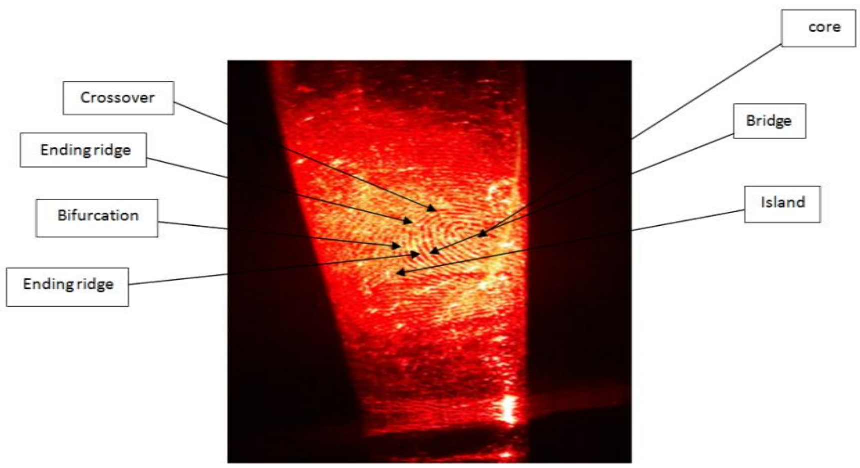
Chapter four

Results and discussions

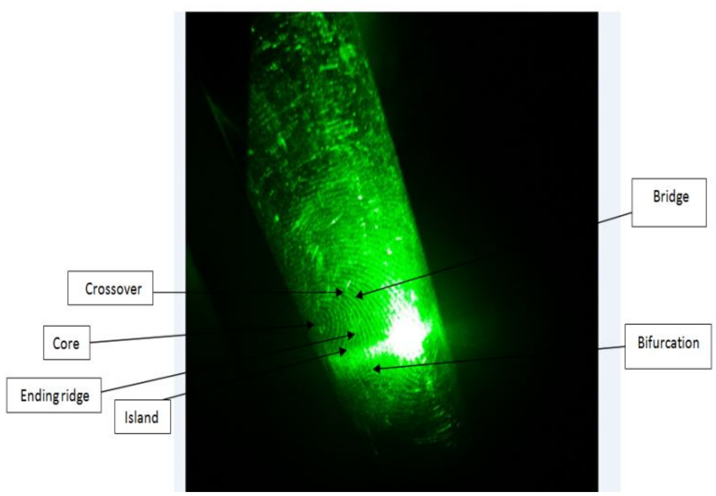
4.1 Results

4.1.1 Aluminum surface:

Figures 4.1 a) and b) show a photo of fingerprints that has been appear by laser exposure with power 1mW and laser with 5mW on an aluminum knife surface as shown below:



(a)



(b)

Figure 4.1 fingerprint on the surface knife aluminum (a) by laser with power1mW and (b) by laser with power 5mW

When He-Ne laser with output power of 1mW exposed on aluminum knife surface a fingerprint with six different patterns appear, with the following characteristic:

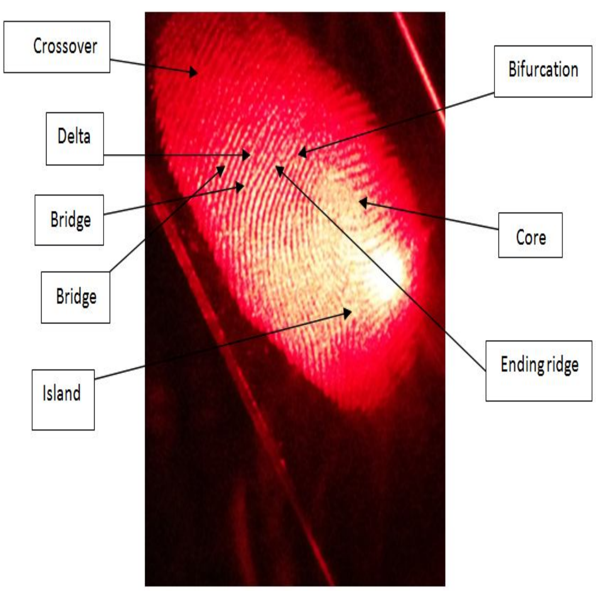
1-Island	2- Core	3- Bridge
4- Bifurcation	5-Ending ridge	6- Crossover

While diode laser pointer with output power of 5mW used to expose on aluminum knife surface the showing fingerprint with six different following patterns:

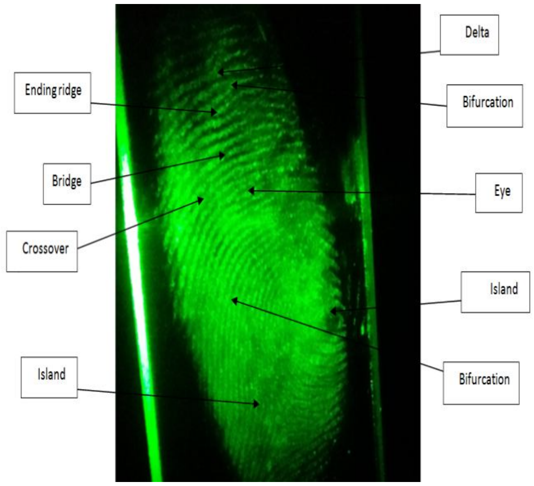
1-Island	2- Core	3- Bridge
4- Bifurcation	5-Ending ridge	6- Crossover

4.1.2 Glass surface:

Figures 4.2 a) and b) show a photo of fingerprints that has been appear by laser exposure with power 1mW and laser with 5mW on a microscopic glass slide surface as shown below:



(a)



(b)

Figure 4.2 fingerprint on the microscopic slides surface (a) by laser with power1mW and (b) by laser with power 5mW

When He-Ne laser with output power of 1mW exposed on microscopic glass slide surface a fingerprint with seven different patterns appear, with the following characteristic:

1-Island 2- Core 3- Bridge 4- Bifurcation

5-Ending ridge 6- Crossover 7- Delta

While diode laser pointer with output power of 5mW used to expose on microscopic glass surface the showing fingerprint with seven different following patterns:

1-Island 2- Core 3- Bridge 4- Bifurcation

5-Ending ridge 6- Crossover 7- Delta

4.2 Conclusion:

The conclusion that , the fingerprint was shown on the surfaces of aluminum and glass using a He-Ne and Diode lasers with output power of 1mW and 5mW respectively resulted in good results in a short time and less cost than chemical demonstration methods.

4.3 Recommendations:

Based on the revealed results the following recommendations are offered for related research in the field of fingerprint detection:

Additional research is needed to study the detection of the fingerprints with other different types of lasers.

Consider the use of lasers to detect fingerprints in different surfaces.

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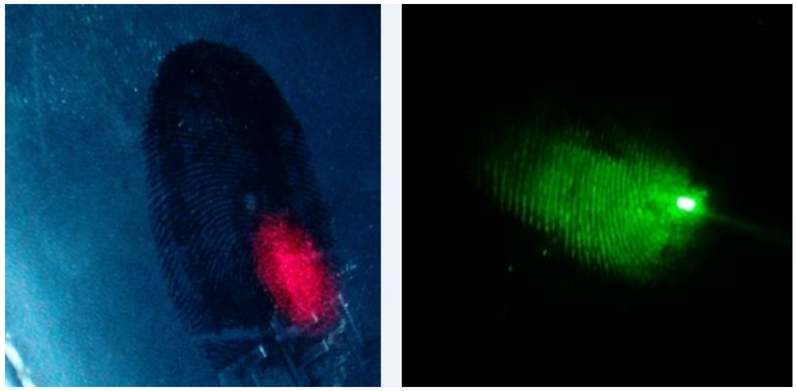
Apendex One

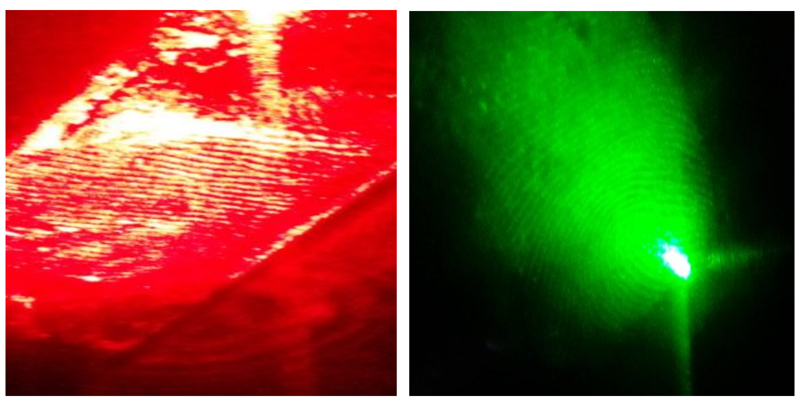


a) b)

Figure1.1 Artificial leather surface

Fiugure 1.1 is fingerprint in the Artificial leather surface (a) Using he-ne laser and (B) using diods laser

Apendex Two



a) b)

Figure 2.1 Metal surface

Fiugure 2.1 is fingerprint in the Metal surface (a) Using he-ne laser and (B) using diods laser