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Design of Low Cost Laryngoscope with Video Streaming

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Abstract: This work aims at high frame rate laryngoscope which can be able to visualize a human vocal fold with high pixel rate. The resultant image may be useful in pathology, the out-patient clinic and in-patient ENT consultation. During anathesia, it can be aided for fibre- optic intubation. The low cost USB endoscopy camera gives high quality images which can be used for teaching and to give vocal treatment to patients. The display device used here is 3.5 inch touch display with IPS technology, high quality and perfect displaying from wide viewing angle. The main objective of this paper is to design a video laryngoscope with minimum cost that can be used in patients with reduced neck extension and minimal mouth opening.
Keywords: IPS technology, Laryngoscope, Pathology, USB endoscope.

I. INTRODUCTION

The laryngoscope has been designed with optical principles to provide clear view of vocal path of patients located more anterior to straight line of vision. There are many types of laryngoscopes are available in current scenario. But for this purpose we particularly use Macintosh Laryngoscope. By using this laryngoscope many specification and operational characteristics have been developed. The laryngoscope has an optical accessories, a different blade angles and an oxygen low apparatus attached to the device. We developed a high frame rate video based laryngoscope that can simultaneously extract and visualize vocal fold vibrations by introducing a high-speed vision platform that we have designed for 256*512 – pixel images at 4000 fps; we evaluated the laryngoscope under clinical conditions by quantifying the left-right asymmetry of vocal-fold vibrations of human objects, some of whom were patients with laryngeal diseases. .

II. LITERATURE SURVEY

A. Direct Laryngoscope

Direct laryngoscopy remains to be the best method of choice in endo-tracheal intubation. However, it is difficult to perform direct laryngoscope in 1-4% of the patients. Devices are being invented to facilitate the laryngoscopy and intubation where video laryngoscopes play a key role. Most of these devices demand reasonable mouth opening and they occupy most of the oral cavity-limiting the space to introduce the endo-tracheal tube (ETT). Even though they facilitate visualization of Larynx, they do not aid passing the ETT through the glottis. This is mostly experienced when the larynx is situated much anteriorly.

B. The Development of Direct Laryngoscopy

The use of direct laryngoscopy for endo-tracheal intubation is one of the key skills of anesthesiologists and every physician involved in airway management. Direct laryngoscopy confers the known advantages of familiarity, direct glottic visualization, cost effectiveness, equipment availability, and a steep learning curve. However, the prevalence of insufficient views of the glottis is persistent therefore, alternative intubation techniques should be available in such a crucial situation, including indirect laryngoscope techniques such as video laryngoscopy. Current video laryngoscopes play an important role in the management of an unexpected difficult airway. Additionally, the use of a video laryngoscope may be considered in predicted difficult airway, if mask ventilation and oxygenation can be warranted. However, it is important to know that video laryngoscopes do not build a homogeneous class; moreover, they differ in design, technical configuration, and monitor type and, most importantly, in blade type, so that the user has to become familiar with each device before they are used in an emergency situation.

Therefore, the greatest benefit from video laryngoscopy may be obtained, if it is used routinely in elective cases to become familiar with the device outside of the difficult intubation situation. In this case, video laryngoscopy has the potential to save time and decrease patient morbidity. This review addresses actual video laryngoscopy techniques and their use in both clinical and pre-hospital airway management scenarios. The comparison between video laryngoscope and direct laryngoscope is shown in table: 1

	Video laryngoscope	Direct laryngoscope
First attempt success rate	74%-83%	23%-40%
Short intubation time	9~16 sec faster	9~16 sec faster
Eye-airway lineup	Less patient repositioning	Alimrn is necessary
Patient stimulation	Stable vital sign	Fluctuating vital sign
Education tool	Guiding the learners	Learn from the experience

Table 1: The comparison between video laryngoscope and direct laryngoscope

A Binocular Vision System for Object Distance Detection with SIFT Descriptors: The purpose of the real-time monitoring of target or incident is to have a timely alarm, to find the invasion of effective goal is the core technology. Distance measuring of intrusive targets is important for indoor monitoring, according to the detected intrusion target image, calculating the distance between the target and the camera, it can provide the basis for the computer to determine the type of invasion, and finally provide information for the security alarm. In order to meet the needs of the indoor environment monitoring, the paper hereby presents a set of binocular vision-based motion detection system. The system is divided into two parts, one part is offline training, and another is online. In motion detection module, for dual-channel video capture respectively, the background subtraction algorithm is us the mean time, revised distance parameter module provides a correction parameter for the traditional binocular parallax distance formula. Finally, the distance between the target and the camera is calculated. Extracting moving targets, getting match points then measuring distance, especially in distance measuring of obstructed targets.

III. HISTORY OF LARYNGOSCOPY

The history of laryngoscopy, as that of all medicine is rich in personalities and anecdotes. Advances that we take for granted in contemporary practice did not evolve in an orderly fashion. The convention that an idea is born, recognized and accepted in orderly progression is an illusion. Inventive minds circle around problem, at times encouraged by other technologic advances or by boldly discarding outdated dogma. Ideas are proposed, rejected, reinvented and eventually accepted in an ascending spiral that advances medical knowledge.

Figure 1.Gustave Killian performing suspension laryngoscopy, 1919. The patient’s head is suspended by attaching the laryngoscopy to the “gallows”.

Suspension laryngoscopy was developed by Gustave Killian, who first happened upon the idea of suspending the larynx of the supine patient for examination and surgery. As with many innovation, this one had a serendipitous beginning. At the turn of the century, direct laryngoscopy using a tubular spatula like device was in vogue. In the winter of 1909 Killian, who needed accurate drawing of the larynx for a paper, entered the dissection rooms of the University of Freiburg with his medial artist.

IV. TYPES OF VIDEO LARYNGOSCOPES

There are many different video laryngoscopes out there, but they generally boiled on to two basic types. Those that use hyper angulated blades to "see around the corner" (such as the glideslope that is currently available in Auckland ED), and those that use Macintosh style blades that are connected to a video screen (such as Storz C-MAC).
Hyper angulated VL blades often allow super laryngeal visualization with the down side that tube delivery requires a different technique with an angulated stylet, were as Macintosh style blades allow for the use of the same tube delivery technique through direct laryngoscopy or indirect laryngoscopy.

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Figure 2. Types of Video Laryngoscopes

Although the literature is still not clear on this issue, it would appear that some patients are more easily intubated with direct laryngoscopy with a standard blade, and others are more easily intubated with a hyper angulated blade, so intuitively it makes scense to have both options available.
The C-MAC we are trailing as a Mac-3, Mac-4 and a hyper angulated D-Blade option. Potential advantages include the ability to turn the screen away from the airway operator whilst using the MAC-Blade to allow teaching under the resuscitation team to see what sort of actual view is being obtained (some times this info just ain't forth coming in real time!), allow assistants other than the airway operator to perform suction under visualization, and as a hyper angulated blade should a poor view obtained with a standard MAC-Blade.

V. LARYNGOSCOPE BLADES

The following results were developed using raspberry pi run on a computer. Tests were conducted to test the accuracy of the object distance, and the impact of changing the focal length. The camera we used is a Canon 5D Mark II DLSR camera with EF 24-70mm f/2.8L lens. The size of the image sensor is 36x24mm.The lens can zoom from 24mm to 70mm. The camera and zoom lens are show in . The camera and zoom lens Due to the lack of equipment, the stereo image is done by using only one camera moving on the track. The object can be measured for its distance when it enters the overlapping view of the camera at two different locations. This is especially designed for blind people.

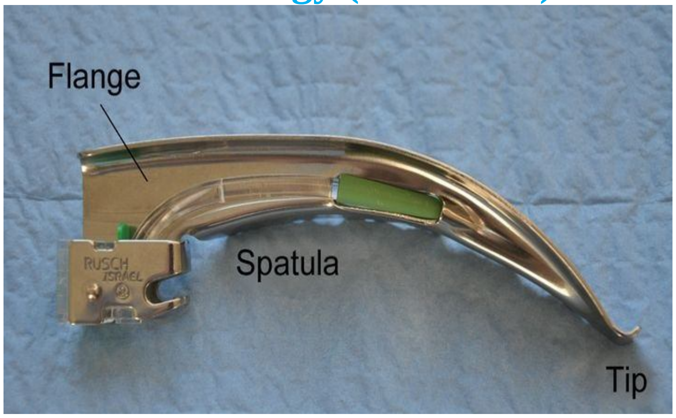

Figure 3 : A laryngoscope

A laryngoscope is composed of a handle and a blade that contains a light source. Improved illumination with light-emitting diodes or fiber optic light transmission has replaced incandescent bulb technology in recent years, improving laryngoscope design. The laryngoscope blade itself consists of three components: a spatula, which passes over the lingual surface of the tongue: a flange, which is used to direct or displays the tongue: and a tip, which is designed to lift the epiglottis either directly or indirectly.

A multitude of laryngoscope blades have been designed which highlights some of the characteristics and advantages of various types of curved and straight blades. Two basic blade designs dominate: curved blades exemplified by the standard Macintosh deign and straight blades such as the common miller blade. The large flange of the machine toss is designed for the tongue displacement, and the curved blade is designed to elevate the epiglottis indirectly. like other straight blades , the miller designed to lift the epiglottis directly and is particularly useful if a large , floppy , or irregularly shaped epiglottis is encounted during laryngoscope these are available with variously sized blades and handles (Standard , pediatric , or short) to accommodate patient size , anatomic characteristics , and operated in general , straight blade designs as defined by the dimensions of their spatula and flang have smaller displacement values and are favored in patients with smaller displacement space (ex, children are patients micrognathia , prominent upper incisors, or short mental – hyoid distance). Curved blades like the machine toss may be favored for tongue control or ease of intubation. in at least one study , the miler blades profile was found to provide a better view laryngeal structures , but the machine toss blades facilitated seed and ease of intubation.

	Country	Blade shape	Monitor	Portabity	Disposability
Trachway	Taiwan	MAC & Angulated blade	Integrated	Yes	Reusable
Storz C-MAC	Germany	Standard Macintosh blade	Separate	Yes	Reusable
Glidescope	USA	Angulated blade	Separate	No	Reusable
McGrath	USA	Angulated blade	Integrated	Yes	Single use blades
Pentax-AWS	Japan	Blade with a guide channel	Integrated	Yes	Single use blades
Airtraq	Spain	Blade with a guide channel	Separate	Yes	Reusable

Table 2: Object size and distance measurements

VI. OPERATION

The video laryngoscope was introduced into clinical practice by Kaplan and Berci. The video laryngoscope is built like a standard Macintosh laryngoscope with fiber optics fibers built into the end of the blade. This way the video laryngoscope allows at the same time a direct view, like the view with a normal Macintosh blade, and the view of the camera at the end of the blade projected on a monitor. The camera projects the image in real time to a portable video system with the option to record sequences or pictures. For the study, blades Macintosh size three and four were used. Size of the blades and tracheal tubes (7.0-8.0 mm ID) were used to the discretion of the intubating anaesthesiologists.After having obtained the consent, the patient was assigned to tracheal intubation via direct laryngoscopy or video laryngoscopy according to a omputer-based randomization list. Before induction of anaesthesia, the anesthesiologist performing the tracheal intubation confirmed the Mallampati score and started preoxygenation.

The patients were placed in the supine position with their head on a 7 cm headrest. General anaesthesia was induced according to the preference of the attending anesthesiologist. The attending anesthesiologist decided when to start the intubation attempt and the time for the procedure was then noted.

Figure 4 : over video laryngoscopy

The initial attempt for most patients in the study was direct laryngoscopy. The preference for direct laryngoscopy over video laryngoscopy is probably in part due to the lack of experience with the device and in part because there were only two Glide Scopes in the department during the study period. ED providers were aware that a study was being conducted. This may have encouraged them to attempt to intubate the patient more rapidly or use video laryngoscopy when they otherwise might not have. Sedation and paralysis are used in the large majority of intubations in our ED, and their use was not specifically recorded for the study. We think it unlikely that there were meaningful differences in the type of sedation or paralysis used between the groups. There are several video laryngoscopes currently on the market; we studied the Glide Scope, and our results reflect only the performance of this device. Future changes in the shape of the blade and stylet and the design of the light, video camera, and monitor may change the performance of video laryngoscopy equipment.

. VII. CONCLUSION

This device can be used as an alternative advanced laryngoscope in anticipated difficult airways as well as a rescue method in airway emergencies. Lightweight, maneuverability, durability and significantly low manufacturing cost of this novel model will make a huge difference in management of difficult airway situations.

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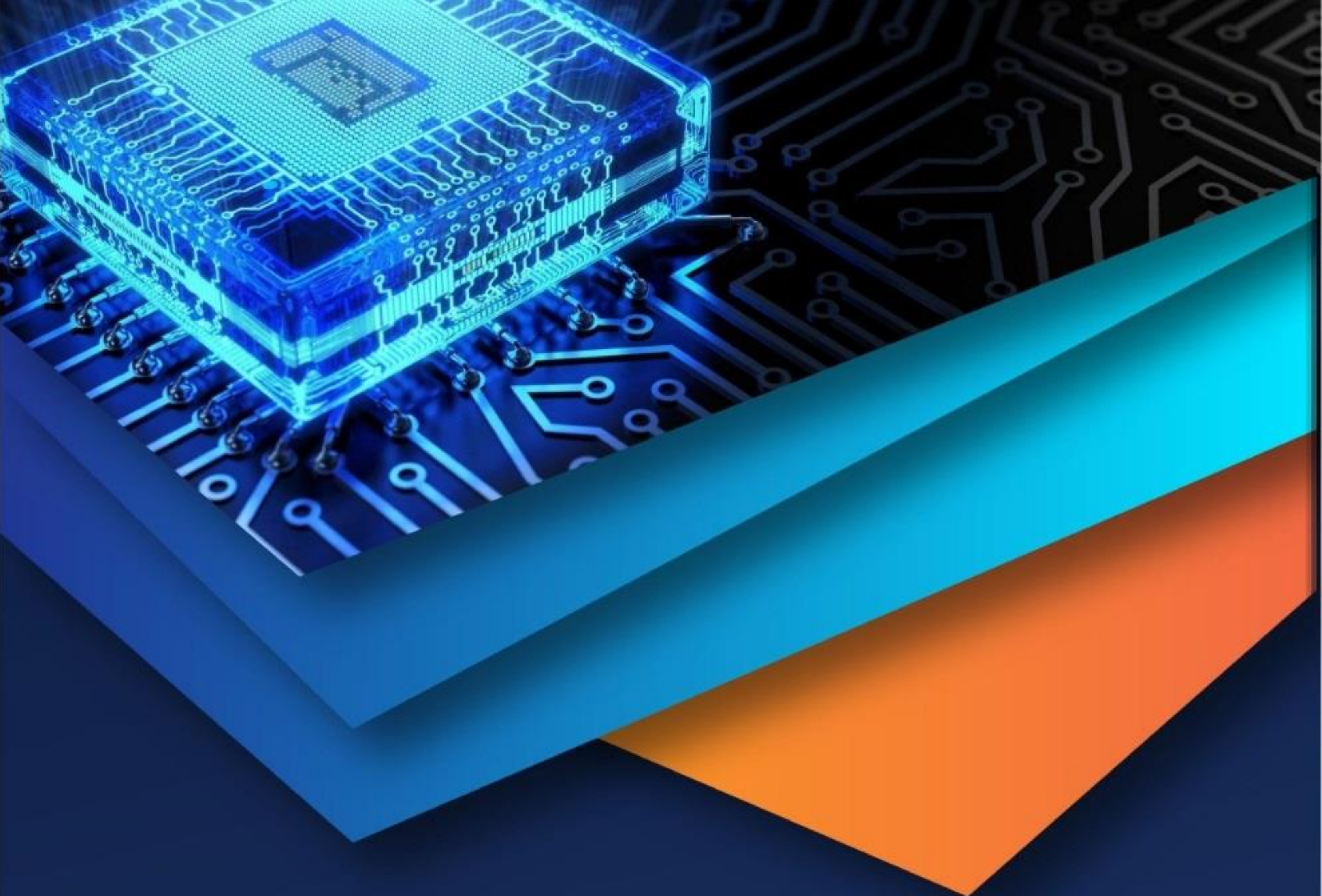

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