DESIGN OF AN ACCESSORIES FOR ENDOSCOPE FOR CAPTURING STABILIZE IMAGE

A DISSERTATION

SUBMITTED IN PARTIAL FULFILLMENT OF REQUIREMENTS

FOR THE AWARD OF THE DEGREE

OF

MASTER OF DESIGN

IN

[PRODUCT DESIGN]

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Candidate's Declaration

I, **Vinay kumar pradhan, Roll No - 2K21/MDPD/14**, student of M.Des (Department of Design), hereby declare that the project Dissertation titled **"DESIGN OF AN ACCESSORIES FOR ENDOSCOPE FOR CAPTURING STABILIZE IMAGE"**Which is submitted by me to the Department of Design, Delhi Technological University, Delhi in partial fulfilment of the requirement for the award of the degree of Master of Design is original and not copied from any source without proper citation. This work has not previously formed the basis for awarding any Degree, Diploma Associateship, Fellowship, or other similar title or recognition.

Place: Delhi

Vinay Kumar Pradhan

Date: 20.06.2023

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Certificate

I hereby certify that the Project Dissertation titled **"DESIGN OF AN ACCESSORIES FOR ENDOSCOPE FOR CAPTURING STABILIZE IMAGE "** which is submitted by **Vinay kumar pradhan**, Roll No - **2K21/MDPD/14**, **Department of Design**, Delhi Technological University, Delhi in partial fulfillment of the requirement for the award of the degree of Master of Design, is a record of the project work carried out by the students under my supervision. To the best of my knowledge, this work has not been submitted in part or full for any Degree or Diploma to this University or elsewhere.

Place: Delhi
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ABSTRACT

The self-diagnosis of ENT disorders is becoming increasingly common in today's digital age, with patients often using online resources to research their symptoms and attempt to identify their condition. This master thesis project aims to improve self-diagnosis of ENT by exploring the development of tools and technologies that can assist in this process. The project follows the Double Diamond design method, which involves four phases: Discover, Define, Develop, and Deliver. The literature review highlights the advancements in otoscopy and endoscopy technologies, including the use of video-otoscopes and portable ear endoscopes. Intraoral cameras have also been proven effective in dental practice for diagnosis and patient education. The methodology section outlines the design brief, the discovery phase, and provides an introduction to endoscopy and endoscope construction. The objective of the project is to conceive and create working prototypes of novel applications for endoscopic cameras in various domains. The project aims to contribute to the improvement of medical diagnoses and treatments through the use of advanced endoscopic technologies.

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INTRODUCTION

1.1 PROJECT BACKGROUND

The self-diagnosis of ENT disorders is becoming increasingly common in today's digital age, with patients often using online resources to research their symptoms and attempt to identify their condition. This master thesis project aims to improve self-diagnosis of ENT by exploring the development of tools and technologies that can assist in this process. There has been growing interest in the development of tools and technologies that can assist in the self-diagnosis of ENT disorders. These tools include smartphone applications, online symptom checkers, and self-assessment questionnaires. The use of such tools has the potential to improve patient outcomes by enabling earlier diagnosis and treatment of ENT disorders. However, the accuracy and reliability of these tools are still under investigation, and caution should be exercised when using them. While tools and technology could help with self-diagnosis, they should never take the place of advice from a trained healthcare practitioner. There is a general mistrust of the healthcare system among some individuals, who may feel that healthcare professionals do not take their symptoms seriously or do not provide adequate care. This has led to a preference for self-diagnosis and self-treatment, as individuals feel that they are better able to manage their own health than healthcare professionals. Additionally, there is a growing desire among individuals to take control of their own health and to be more informed about their symptoms and potential conditions. The widespread availability of information online has made it easier for individuals to access medical information and to learn about potential diagnoses. In conclusion, the self-diagnosis of ENT disorders is a complex and evolving area of interest that requires careful consideration and further investigation.

1.2 DESIGN METHOD

The Double Diamond design method is a creative problem-solving approach that helps teams to develop innovative solutions by following a structured and iterative process.it is based on the idea that design is not a linear process, but rather a cyclical one that involves divergent and convergent thinking.

The Double Diamond method consists of four phases:

- **Discover:** The Discover phase involves conducting research and exploration to acquire knowledge and identify potential opportunities. This encompasses the activities of gathering information, conducting candidate interviews, and monitoring user behaviours. The objective is to comprehensively comprehend the issue at hand and its contextual surroundings.
- **Define:** In this phase, the problem and associated challenges are delineated based on the knowledge gained during the discovery phase. This involves synthesizing the findings of the study and emphasizing the most significant insights and potential avenues for further exploration. The objectives are to establish a precise definition of the problem and to narrow down the focus.
- **Develop:** The development stage involves the generation of a diverse range of ideas and potential solutions. This necessitates the utilisation of prototyping, sketching, and ideation. The aim is to examine multiple alternatives and generate outcomes.
- **Deliver:** During this stage, the solutions that were previously developed are subjected to testing and refinement. The process entails conducting user testing on the prototypes, collecting feedback, and iteratively improving the solutions based on the received feedback. The aim is to formulate a comprehensive solution that meets the needs of the stakeholders and effectively resolves the problem identified in the initial stage of the project.

that the design in consistent in all the digital platforms like desktop, mobile, tab and everything else, so that it makes user easy to identify and navigate through the product.

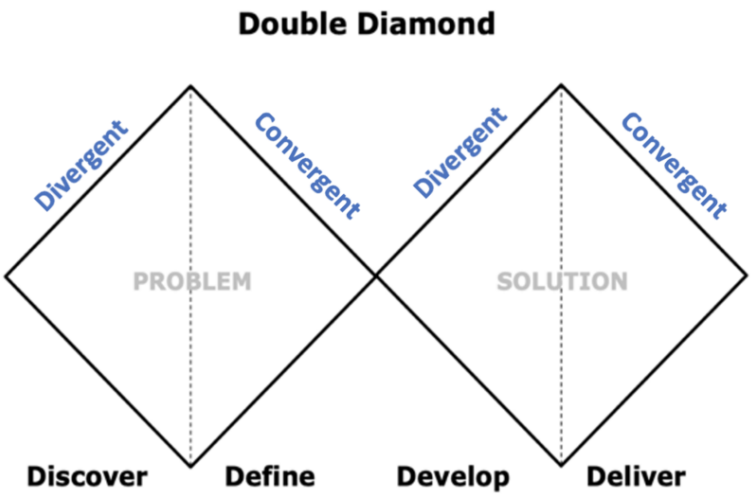


FIGURE SEQ FIGURE * ARABIC 1.1 DIAMOND DESIGN PROCESS

CHAPTER-2

LITERATURE REVIEW

2.1 LITERATURE REVIEW ON RESEARCH PAPER

- Samuel R.Falkson; Prasanna Tadi ,Stanford University School of Medicine Asram Medical College, Eluru, India result shows that Otoscopy is a clinical procedure used to examine structures of the ear. It involves using an otoscope to visualize the ear anatomy, including the external auditory canal, tympanic membrane, and middle ear. Factors that can make successful otoscopic examination difficult include poor lighting of the ear canal, suboptimal positioning of the otoscope, cerumen blockage, insufficient training in otoscopic technique, and lack of confidence in performing the otoscopic examination. Video-otoscopes have been introduced in recent years and studied for their efficacy in diagnosing ear conditions, with some research suggesting they may be superior to conventional otoscopy.
- Li Xiaowen, Zhang Milin, Wang Zhihua , Amine Bermak ,Department of Electronic Engineering, Tsinghua University, Beijing 100084, China, Department of Electronic and Computer Engineering, Hong Kong University of Science and Technology, Hong Kong, China, Institute of Microelectronics, Tsinghua University, Beijing 100084, China, A digital pixel image sensor array and image processor were integrated to create a smart image sensor for wireless endoscope capsules. The camera-on-a-chip design allowed for efficient packaging and power consumption. Power reduction techniques, including gray coding, power gating, filtering, and compression, were implemented at the architectural and circuit levels to minimize power dissipation.A dedicated clock management scheme in the JPEG-LS engine reduced power consumption by 15.7%. The smart sensor was implemented in 0.18 μm CMOS technology.

- As per Mayo Clinic During capsule endoscopy, a camera captures numerous color photos as it travels through your digestive system. The saved images are then transferred to a computer with specialized software that creates a video by stringing them together. The video is used by your doctor to identify any abnormalities in your digestive tract. After the procedure, it may take a few days to a week or more for your doctor to analyze the results and share them with you.
- “Intraoral Camera Use in a Dental School Clinic”: Evaluations by Faculty, Students, and PatientsMichael Murrell , Leonardo Marchini , Derek Blanchette , Sato Ashidaa smart image sensor was developed for wireless endoscope capsules. The sensor integrates a digital pixel image sensor array with an image processor, resulting in a camera-on-a-chip architecture. Power reduction techniques were implemented at the architectural and circuit level, including gray coding, power gating, filtering, and compression. These techniques significantly reduced power consumption in the sensor array, data transmission, and the JPEG-LS engine. The smart sensor was implemented in 0.18 μm CMOS technology, enabling improved power efficiency and packaging design for wireless endoscope capsules.
- The use of intraoral cameras in dental practice: a review" by Elif Bahar Tuna et al. (International Dental Journal, 2019): This paper reviewed the literature on the use of intraoral cameras in dental practice. The authors found that intraoral cameras were useful for improving patient communication, enhancing diagnosis, and documenting treatment outcomes.
- “Clinical applications of intraoral camera to increase patient compliance - current perspectives” Kalyana-Chakravarthy Pentapati Technological advancements in dentistry have revolutionized the use of photography as a powerful tool for expression and communication. Intraoral cameras (IOCs) have become widely used in dental clinics, allowing for the detection of hidden defects and overlooked issues in teeth and the oral cavity. IOCs enable detailed recording of microstructures in dentistry, facilitating patient education, record-keeping, treatment planning, lecture illustrations, publications, and web connectivity for complex cases. This review highlights the important

applications of IOC in dentistry and its potential impact on improving patient compliance with dental care.

- “Comparison of endoscopic and microscopic ear surgery in pediatric patients: A meta-analysis”Sang-Yoon Han , Doh Young Lee , Juyong Chung , Young Ho Kim .Recently, the endoscope has been increasingly introduced for middle-ear surgery. To evaluate the postoperative outcomes of endoscopic ear surgery (EES) in pediatric patients, we did a qualitative analysis with a systematic review and quantitative analysis with meta-analysis of available literature.

CHAPTER 3

METHODOLOGY

3.1 DESIGN BRIEF

Endoscopic cameras are specialised cameras that are used to record photos and movies of interior organs and tissues, and our goal is to create new uses for these cameras. This project's objective is to conceive of and create working prototypes of novel applications for endoscopic cameras that may be put to use in a variety of domains, including medical, industrial inspection, and scientific research, among others.

To complete the objective Double Diamond design process was used

3.2 DESIGN PROCESS(DISCOVER)

3.2.1 INTRODUCTION TO ENDOSCOPY

Endoscopy is a medical procedure that allows doctors to visually examine the inside of the body, typically in a minimally invasive manner. It involves using an endoscope, which is a long, thin, flexible tube with a tiny camera and light at the end. The camera sends high-quality images of the internal structures to a monitor, enabling doctors to observe and diagnose conditions in real-time.

Endoscopes are widely used in many medical fields, including gastroenterology, urology, gynaecology, pulmonology, and otolaryngology. They have revolutionized modern medicine by enabling non-invasive examination of the internal body, Enabling medical practitioners to diagnose, provide medical care, and oversee a diverse array of health conditions and illnesses.

Endoscopy finds one of its most prevalent applications in the domain of gastroenterology, wherein it is employed to scrutinize. the digestive system.. Gastrointestinal endoscopy allows doctors to examine the oesophagus, stomach, and

intestines for abnormalities such as ulcers, tumours, or inflammation. In addition to treating symptoms like bleeding or blockage, endoscopy may be used to conduct biopsies, remove polyps or foreign objects, and perform biopsies.

Endoscopy is a procedure performed in the area of urology to inspect the urinary system. A urologic endoscopy may be used to identify diseases including bladder cancer, kidney stones, or enlarged prostate. Additionally, it may be used to carry out treatments like ureteroscopy, which includes diagnosing and treating the ureter, or cystoscopy, which involves inspecting the bladder. In gynaecology, endoscopy is used to examine the female reproductive system. Gynaecologic endoscopy can help diagnose conditions such as endometriosis, fibroids, or ovarian cysts. It can also be used to perform procedures such as hysteroscopy, which involves examining and treating the uterus, or laparoscopy, which involves examining and treating the ovaries or fallopian tubes.

In pulmonology, endoscopy is used to examine the respiratory system. Bronchoscopy, for example, involves examining the airways for abnormalities such as tumors, infections, or inflammation. It can also be used to perform procedures such as bronchoalveolar lavage, which involves washing out the airways to collect samples for analysis.

In otolaryngology, endoscopy is used to examine the ear, nose, and throat. Otolaryngologic endoscopy can help diagnose conditions such as sinusitis, vocal cord disorders, or tumours. It can also be used to perform procedures such as laryngoscopy, which involves examining the larynx, or nasopharyngoscopy, which involves examining the nasal passages and pharynx.

Despite its many benefits, endoscopy does come with some risks, including bleeding, infection, and damage to organs. Therefore, the procedure is performed by trained medical professionals who take necessary precautions and follow strict sterilization protocols to minimize these risks.

In conclusion, endoscopy is a valuable medical procedure that has revolutionized modern medicine by enabling non-invasive examination of the internal body. Its continued development and advancement will undoubtedly lead to better diagnoses, treatments, and outcomes for patients.

3.2.2 INTRODUCTION TO ENDOSCOPE

An endoscope is a medical instrument that is used to visually examine the inside of the body, typically in a non-invasive manner. It is a long, thin, flexible tube with a tiny camera and light at the end that allows doctors to view and capture images of internal organs, tissues, and cavities without the need for major surgery.

Endoscopes are widely used in many medical fields such as gastroenterology, urology, gynaecology, pulmonology, and otolaryngology, among others. They enable physicians to diagnose, treat and manage a wide range of medical conditions and diseases, including digestive disorders, respiratory illnesses, cancer, and many more.

The device's flexible tube design allows it to be inserted into the body through natural openings or small incisions, thereby avoiding the need for extensive surgical procedures. Once inserted, the endoscope transmits high-quality images of the internal structures to a monitor, allowing doctors to observe and diagnose conditions in real-time.

Moreover, endoscopes have evolved over the years to become more advanced and specialized. Some endoscopes are equipped with additional tools and accessories such as forceps, scissors, or brushes that allow doctors to take tissue samples, remove foreign objects, or perform minor surgeries.

Despite their many benefits, endoscopes do come with some risks, including bleeding, infection, and damage to organs. Therefore, the procedure is performed by trained medical professionals who take necessary precautions and follow strict sterilization protocols to minimize these risks.

In conclusion, endoscopes are invaluable tools that have revolutionized modern medicine by enabling non-invasive examination of the internal body. Their continued advancement and development will undoubtedly lead to better diagnoses, treatments, and outcomes for patients.

3.2.3 CONSTRUCTION OF ENDOSCOPE

An endoscope consists of several components that work together to provide a view inside the body. The basic construction of an endoscope includes:

- Outer Sheath: This is the outer layer of the endoscope that protects the internal components and provides stability during insertion.
- Light Source: Endoscopes have a light source, usually a fiber optic cable, that illuminates the internal organs for better visibility.
- Lens System: This component consists of a series of lenses that focus the light onto the object being examined and transmit the image back to the camera.
- Camera: A small camera is attached to the end of the endoscope which transmits the images to a monitor for the doctor to view.
- Control Handle: The control handle is located at the proximal end of the endoscope, and it is used to control the movement of the endoscope tip, as well as to control the accessories that are attached to the endoscope, such as forceps or lasers.
- Channel: Endoscopes also have a channel or multiple channels that run through the length of the instrument, which can be used to introduce instruments or fluids for diagnostic or therapeutic purposes.
- Valves: Valves are located at the proximal and distal ends of the channel, and they control the flow of fluid and air through the instrument during the procedure.
- Cleaning and Sterilization Components: Endoscopes need to be cleaned and sterilized before each use to prevent the spread of infections. Therefore, they have additional components such as flushing channels and sterilization ports. make it short into bullet points.

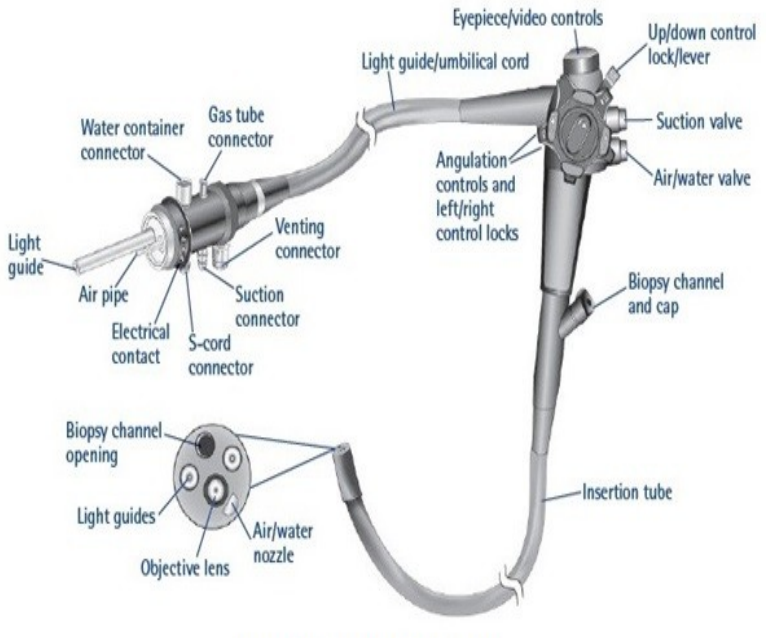


FIGURE 3.1: NOMENCLATURE OF ENDOSCOPE

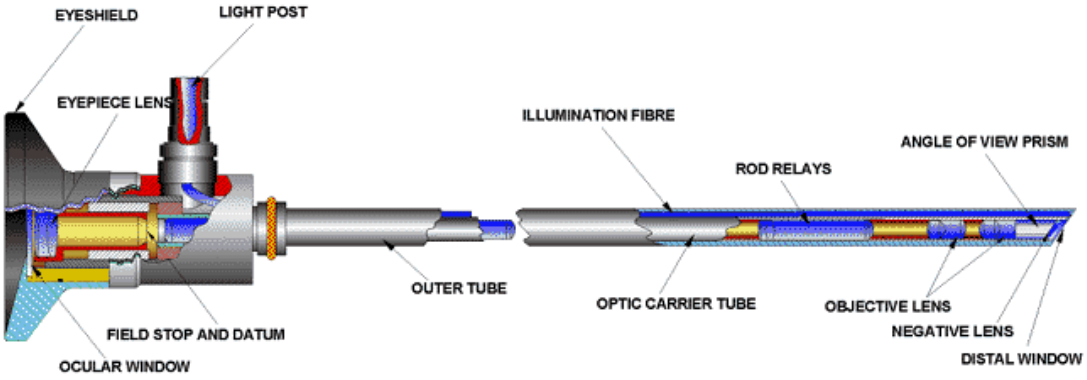


FIGURE 3.2: CONSTRUCTION OF RIGID ENDOSCOPE

3.2.4 ENDOSCOPE FOR PERSONAL USE

The use of personal endoscopes can offer several benefits to patients. One of the most significant advantages is the convenience and accessibility it provides. Patients can use the endoscope at home, without the need for travel to a clinical setting. Additionally, personal endoscopes can allow patients to monitor their health more frequently, which may lead to early detection of abnormalities or conditions.

Personal endoscopes can also be less invasive than traditional endoscopy procedures. In some cases, traditional endoscopy may require sedation or even general anesthesia, which carries its own risks. With personal endoscopes, the need for sedation can be eliminated, leading to a more comfortable experience for the patient.

Challenges and Safety Concerns

Despite the potential benefits, personal endoscopes also present several challenges and safety concerns. One significant concern is the risk of injury or damage to the internal organs of the patient. Endoscopy is a complex procedure that requires a skilled practitioner to perform correctly. Without proper training, patients may inadvertently cause harm to themselves.

Additionally, personal endoscopes may not provide the same level of accuracy and quality as traditional endoscopy equipment. The images produced by personal endoscopes may not be as clear or precise as those produced by clinical equipment, potentially leading to missed or misinterpreted diagnoses.

Another concern is the potential for infection. Endoscopy equipment used in a clinical setting is subject to strict sterilization procedures to prevent the spread of infection. Personal endoscopes may not be subject to the same standards, increasing the risk of infection.

- Product available for personal use of endoscope for ENT
    - **Oral camera** An oral camera is a specialized camera used to capture high-quality images and videos of a patient's oral cavity, including the teeth, gums, tongue, and other structures. These cameras are commonly used by dentists and oral healthcare professionals to examine and

diagnose dental conditions and to monitor the progress of treatment. Oral cameras are designed to be small, portable, and easy to use. They typically feature high-resolution sensors, adjustable lighting, and flexible heads to capture detailed images from various angles. Some models also include software that allows dentists to annotate and manipulate images, enhancing their ability to diagnose and communicate with patients. The use of oral cameras can improve the accuracy of diagnoses, facilitate patient communication, and enhance the overall quality of dental care. They can also be used to educate patients about their oral health and to provide a visual record of treatment progress over time. Overall, oral cameras have become an essential tool in modern dental practice.

FIGURE 3.3: QAWACHH SMART DENTAL CAMERA

FIGURE 3.4: WALDENT INTRA ORAL-CAMERA

- **Ear wax camera:** An ear wax cleaner camera is a specialized device designed to help users clean their ears safely and effectively. It features a camera and a bright light that provides a clear view of the inside of the ear canal, allowing users to see the amount and location of the earwax build up. The camera is typically small and lightweight, and it can be connected to a smartphone or other mobile device via a wireless or wired connection. Some models may also come with an app that allows users to view, record, and share images and videos of their ear canal to remove extra earwax without harming the ear canal or eardrum, ear wax cleaning cameras may be used at home or by medical experts. Additionally, they may be used to detect other ear disorders, such infections or obstructions, and to track the effectiveness of therapy. The use of an ear wax cleaner camera can provide a safe and effective alternative to traditional ear cleaning methods, such as cotton swabs or ear candles, which can be dangerous and potentially harmful. Overall, ear wax cleaner cameras are becoming an increasingly popular and important tool for ear care and hygiene.

FIGURE 3.5: EAR WAX CLEANER

- **Borescope**

  A borescope is a flexible tube with an attached camera that can be used to inspect and capture images or videos of hard-to-reach areas. It is commonly used in various industries such as automotive, aviation, and manufacturing for non-destructive testing and inspection.

  A light source and camera are often located at one end of a long, thin, flexible or stiff tube that makes up a borescope. Users may observe and examine spaces that are challenging or impossible to access with the naked eye thanks to the camera's ability to record and transmit photos and movies that are then sent back to a viewing screen or device.

  A variety of borescopes, including rigid, flexible, and articulating borescopes, are available. Flexible borescopes can bend and manoeuvre through curved spaces, while rigid borescopes are straight and mainly employed for examination of small, straight regions. With its remotely controllable tips, articulating borescopes provide more flexibility and more accurate motions for examination.The use of a borescope can save time and money by enabling more efficient and accurate inspection, without the need for disassembly or destructive testing. It is an essential tool for maintenance, quality control, and safety inspections in various industries.

- **Camera:**

  Difference between mobile camera and endoscope camera

- Purpose: Endoscopy cameras are specifically designed for medical or industrial use, while mobile cameras are designed for general-purpose photography and videography.
- Design: Endoscopy cameras are typically smaller, more lightweight, and more flexible than mobile cameras, with a long, thin, and flexible or rigid tube that can reach and capture images from hard-to-reach areas. Mobile cameras, on the other hand, are typically larger, more robust, and feature a lens and sensor attached to a phone or other device.

- Resolution: Endoscopy cameras often feature higher resolutions and more advanced optics than mobile cameras, allowing for more detailed and accurate imaging of internal organs and tissues or industrial machinery and components.
- Control: Endoscopy cameras are often controlled by a specialized device or interface, such as a joystick or keyboard, while mobile cameras are typically controlled directly by the user through a touchscreen or buttons.
- Sensor Size: Endoscopy cameras typically have smaller sensors than mobile cameras. This is because endoscopy cameras are designed to capture images and videos from small and narrow spaces, where a larger sensor would be difficult to manoeuvre.
- Field of View: Endoscopy cameras often have a narrower field of view than mobile cameras. This is because the camera head is smaller and must fit into tight spaces, which limits the angle at which images can be captured.
- Optics: Endoscopy cameras may have more advanced optics than mobile cameras, including specialized lenses and fibre optics, which enable the camera to capture clear, high-resolution images and videos in hard-to-reach areas.
- Illumination: Endoscopy cameras feature built-in illumination systems, such as fiber optic cables or LEDs, which provide direct lighting to the area being examined. Mobile cameras, on the other hand, rely on ambient light or external lighting sources.
- Connectivity: Endoscopy cameras may be connected to a specialized device or interface, such as a monitor or computer, to allow for real-time viewing and analysis of the images. Mobile cameras, on the other hand, are typically connected directly to a mobile device, such as a smartphone or tablet.
- Control: Endoscopy cameras may be controlled by a specialized device or interface, such as a joystick or keyboard, while mobile cameras are typically controlled directly by the user through a touchscreen or buttons.

- **CMOS sensor**

  In a camera system that uses a CMOS sensor, the signal travels from the sensor to the display through a series of steps. the sensor captures the light that enters the camera lens and converts it into an electrical signal. The sensor is divided into millions of tiny pixels, each of which captures a small portion of the

incoming light. the electrical signals from the pixels are processed by an image processing circuitry, which performs operations such as colour correction, noise reduction, and compression. This processing is usually done on the sensor itself or on an integrated image processing chip. After the processing, the image signal is transferred to the camera's memory or storage device, where it can be stored and/or transmitted to an external device. the image signal is transmitted to the display, where it is decoded and displayed as an image or video. This may be done through a wired connection, such as an HDMI or USB cable, or wirelessly, using a wireless protocol such as Wi-Fi or Bluetooth. the signal from the CMOS sensor travels through multiple processing and transmission steps before reaching the display, where it is ultimately decoded and displayed as an image or video.

3.2.5 USER STUDY

User study was done by using “Matlogix borescope”

3.2.5.1 Objective

The primary objectives of this project are to:

- Identify potential new applications for endoscopic cameras.
- Develop conceptual designs for these new applications.
- Prototype and test the most promising designs.

3.2.5.1.1 Scope: The scope of this project includes:

Conducting research on the current uses of endoscopic cameras in various fields.

Brainstorming and ideating potential new applications for endoscopic cameras.

Developing conceptual designs for these applications, including sketches and diagrams.

Creating physical or digital prototypes of the most promising designs.

Testing and evaluating the prototypes to determine their feasibility and effectiveness.

3.2.5.1.2 Experiment
The experiment was conducted using “Matlogix borescope” having specification

Focus distance	40mm
Camera Diameter	5.5mm
Wire length	1000mm

Table3.1: Specification for Instrument used

- **Viewing ENT without endoscope**

FIG:3.6 Person looking at mirror

FIG:3.7 MOUTH AND THROAT

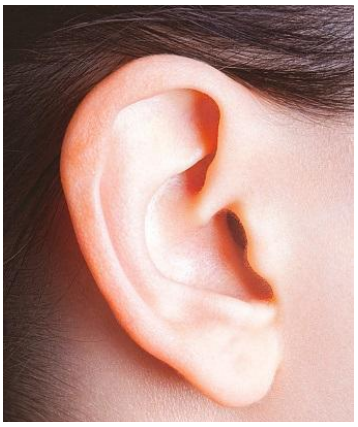


FIG:3.8 EAR

FIG:3.9 NOSTRILS

- **Problem viewing without endoscope**
  The problem occurs without use of endoscope and only use of mirror is that we will not be able to view any parts of our body which are on back side and we required the help other person or some arrangement of multiple mirrors in order to view body parts. Like that some other parts of body which cannot be visible with mirror we need some special arrangement or we need to visit specialist advice which could cost more if there is not any problem then it is waste of money.
    - Not able to view upper jaws
    - Not able to see inside ear
    - Inside nose not visible
    - Not able to view back parts of body.

- **Picture of teeth taken with the help of endoscope:**

FIG:3.10 LOWER JAW AND TEETH

FIG:3.11 UPPER JAW AND TEETH

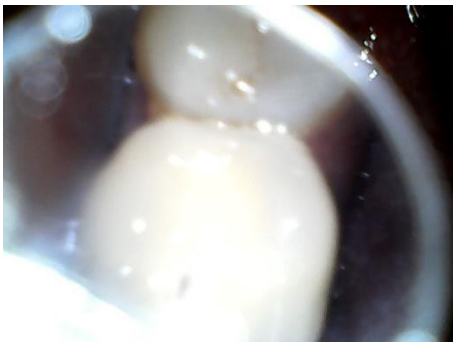


FIGURE:3.12,3.13 BOTTOM LEFT-SIDE JAW AND TEETH

FIGURE:3.14,3.15 BOTTOM RIGHT-SIDE TEETH

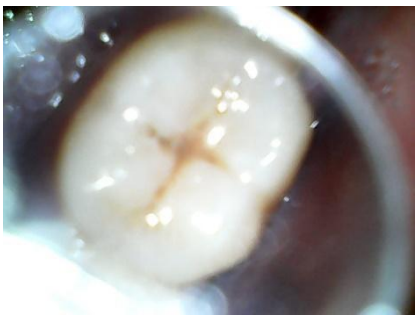


FIGURE:3.16,3.17 TOP LEF-SIDE TEETH


FIGURE:3.18,3.19 TOP-LEFT SIDE TEETH

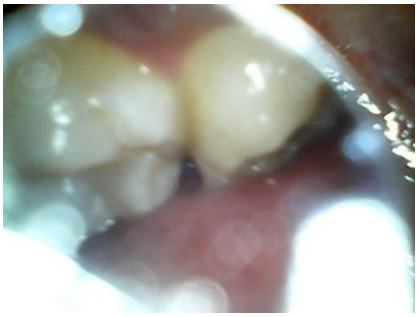



FIGURE:3.20,3.21 TOP LEFT-SIDE TEETH


FIGURE:3.22,3.23 TOP RIGHT-SIDE TEETH

FIGURE:3.24 TOP RIGHT-SIDE TEETH

- **Picture taken to determine focus distance**

FIGURE:3.25,3.26 CAMERA AT 10 MM ABOVE TEETH

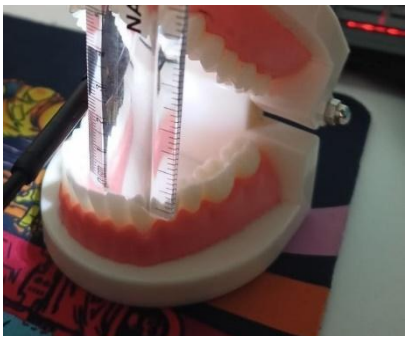


FIGURE:3.27,3.28 CAMERA AT 20 MM ABOVE TEETH

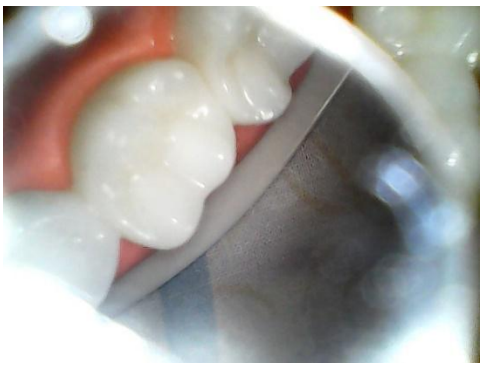


FIGURE:3.29,3.30 CAMERA AT 30 MM ABOVE TEETH

FIGURE:3.31,3.32 CAMERA AT 40MM ABOVE TEETH

- **Picture of Ear taken with the help of endoscope:**


FIGURE:3.33 Back of Ear

Figure:3.34 Left ear

Figure:3.35 Right ear

- **Picture of Nostrils taken with the help of endoscope:**

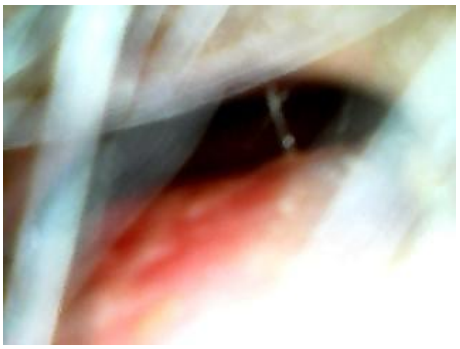


Figure:3.36,3.37 Left Nostrils

FIGURE:3.38 RIGHT EAR NOSTRILS

- **Picture of Nostrils taken with the help of endoscope:**

FIGURE:3.39 THROAT

- **Picture of back taken with the help of endoscope:**

FIGURE:3.40 BACK

- **Picture of back of head taken with the help of endoscope:**

FIGURE:3.41 BACK OF HEAD

Parts of the body can be viewed with the help of endoscope.The body parts which can also be viewed with the help of endoscope are anus , vigina etc

- **Problem faced during taking picture using endoscope**

  The problem occurred while taking the picture with the camera I used

  - Quality of the picture was not good
  - Stability of camera
  - Unable to maintain focus distance
  - Positioning of camera.

3.3 DESIGN PROCESS(DEFINE)

3.3.1 PROBLEM STATEMENT

The challenges in maintaining focus distance when examining teeth to obtain a clear image, ensuring stability of the endoscope, difficulty in self-examination of upper jaws, teeth, and anus, proper positioning of the camera. With the help endoscope also the picture taken was not up to the mark we need some external help in order to maintain focus distance and to keep the camera stable to get clear picture. So that without consulting specialist we can our self-diagnosis our own body parts.

User persona

Name: John

Age: 75

Occupation: Retired

Background: John has always been an active person and enjoyed being outdoors, but as he has grown older, he has experienced some health issues. John is divorced and lives alone in a small town. He doesn't have any children, and his siblings live in a different state.

Goals: John wants to stay healthy and avoid unnecessary doctor visits. He wants to stay informed about his health and be able to diagnose and treat any ENT issues that he may have. He enjoys using medical equipment, such as endoscopes, to examine his own ears and throat.

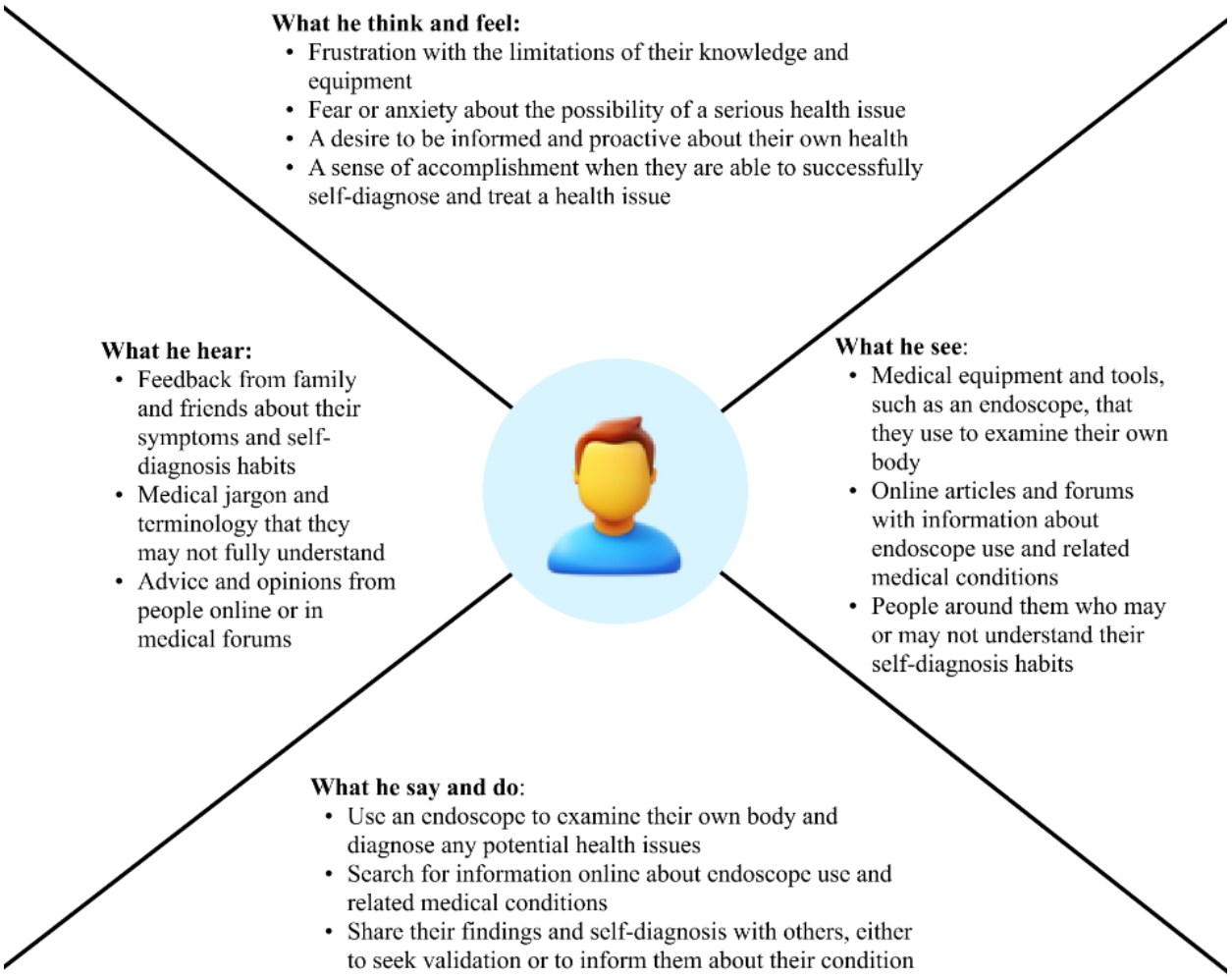
Challenges faced while using endoscope

- Difficulty operating the equipment: He finds it challenging to operate the endoscope, which requires a steady hand and good eyesight. He often struggles

to get a clear view of his own ear canal or throat, which can make it difficult to diagnose any issues.

- Limited view of the affected area: The endoscope only provides a limited view of the affected area, which can make it difficult to identify the root cause of any health issues. JOHN often feels frustrated by the limitations of the endoscope, as he wants to be able to fully understand his own health.

3.3.2 Empathy mapping



3.3.3 DESIGN CRITERIA

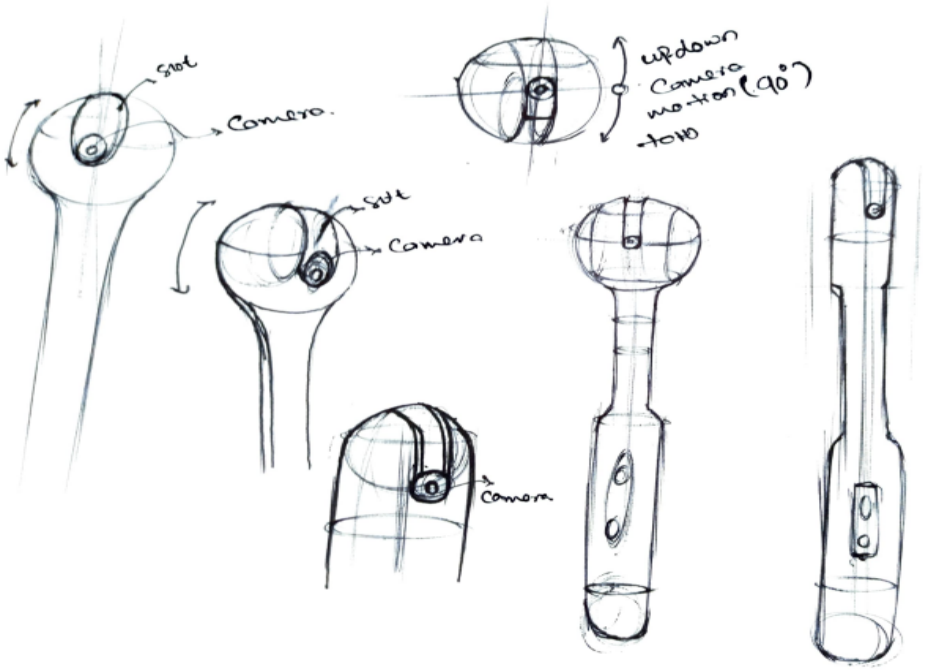
- Should be able to use single device for ENT.
- Should be able to maintain stability and focus to get clear picture while using.
- User should be able to positioned the camera properly.
- Should be able to capture image of portion which are hard to see on Ear, Nose, Mouth, Throat

3.3.4NEED STATEMENT

How might we solve the problem of stability and quality of picture taken during self -inspection of ENT and Different Body Parts.

3.4 DESIGN PROCESS (DEVELOP)

3.4.1 INITIA



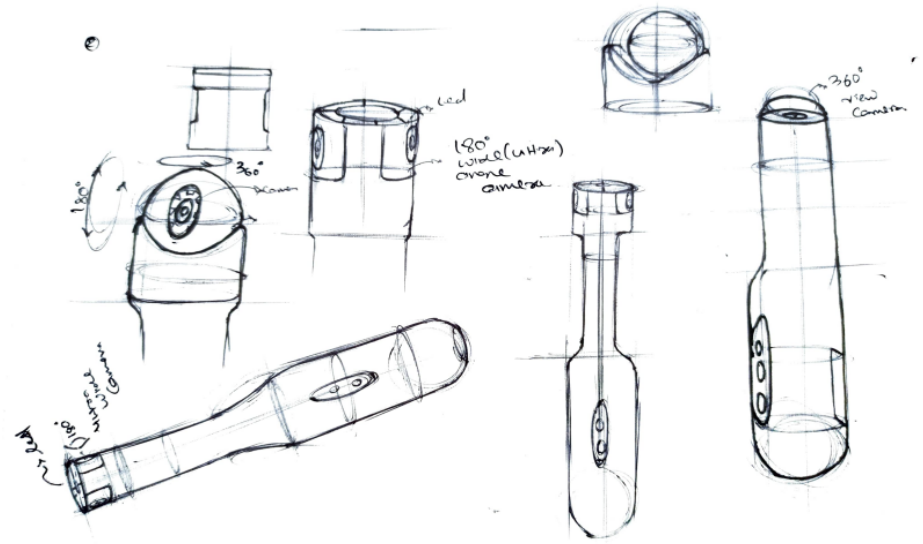


FIGURE:3.44 CONCEPT FOR ENDOSCOPE

3.4.2 CONCEPT SKETCHES

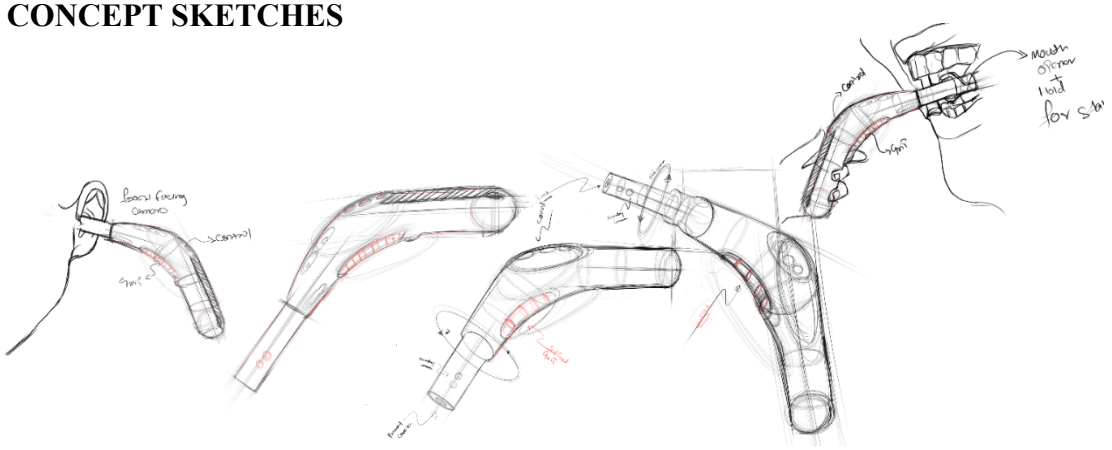


Figure:3.45 concept for endoscope

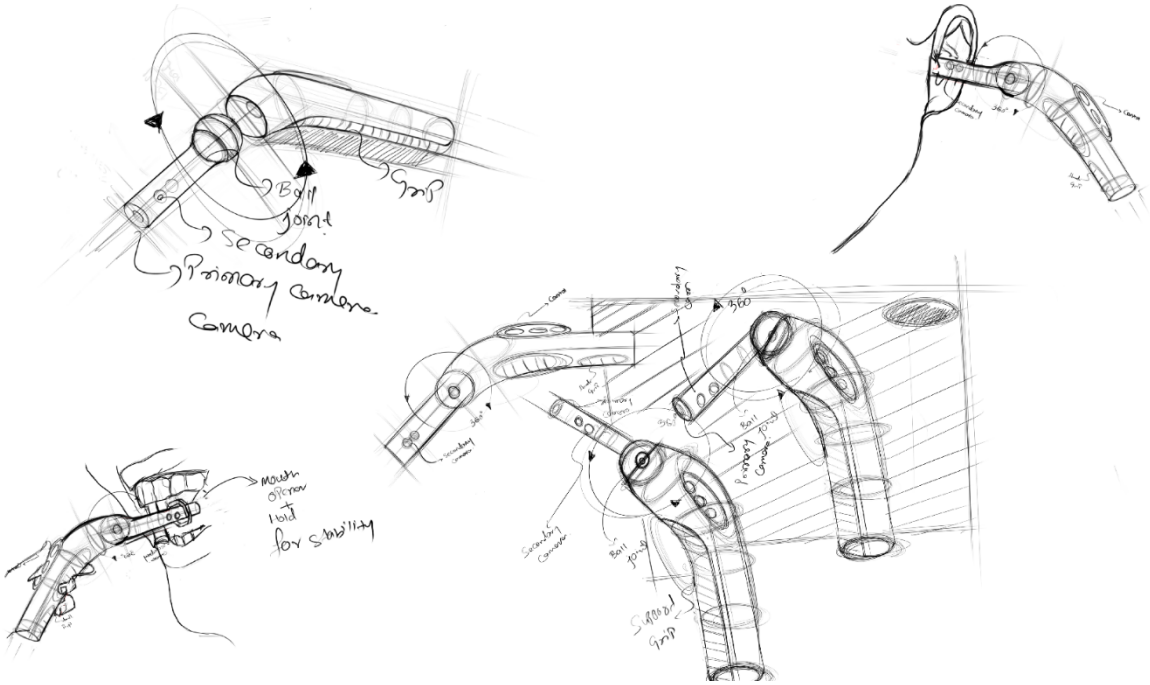


Figure:3.46 concept for endoscope

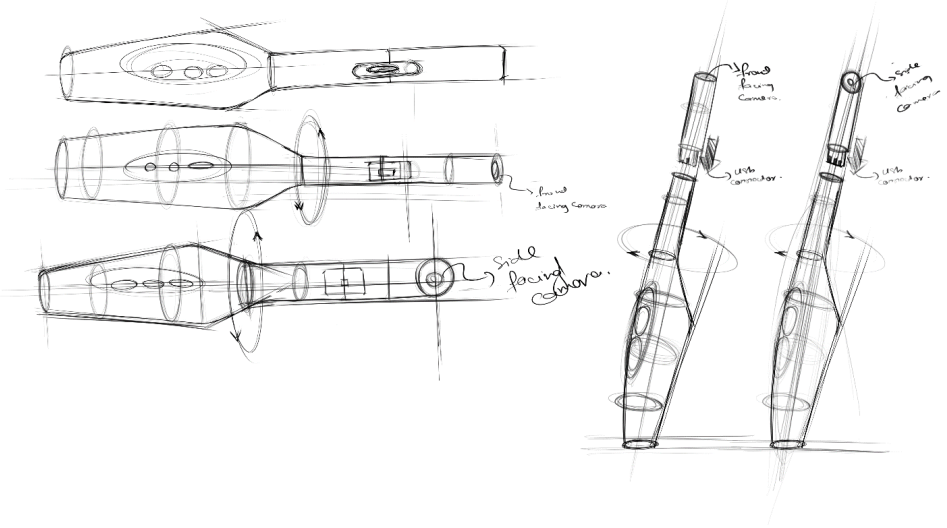


Figure:3.47 concept for endoscope

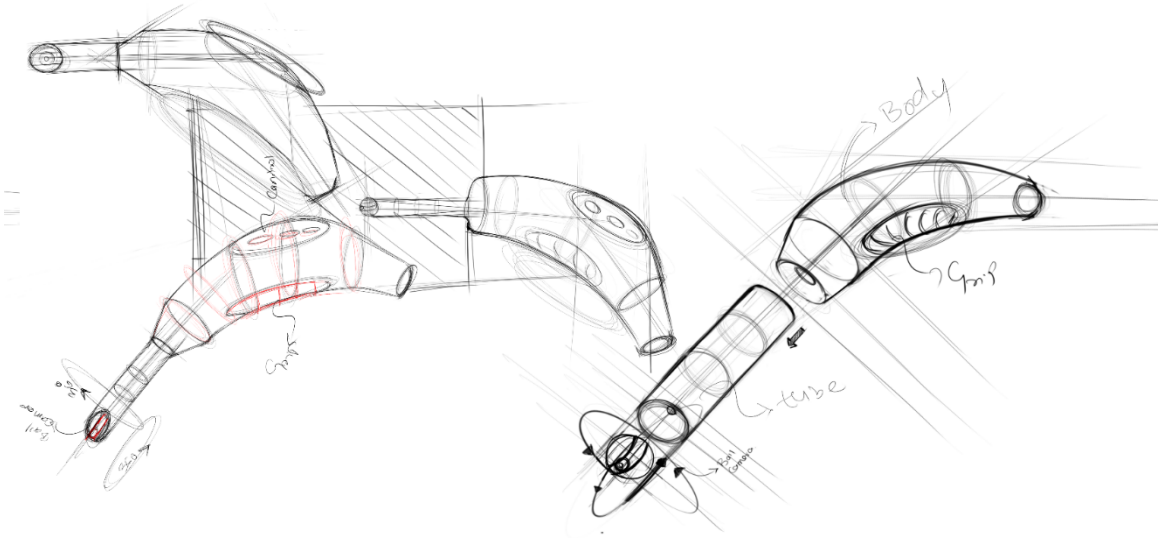


Figure:3.48 concept for endoscope

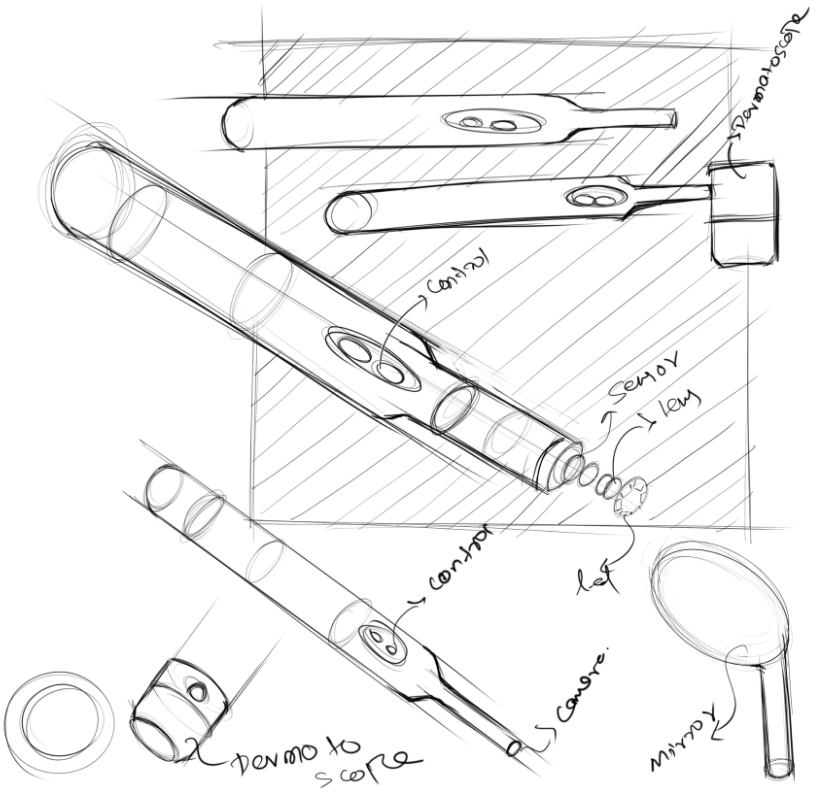


FIGURE:3.49 CONCEPT FOR ACCESSORIES
ENDOSCOPE

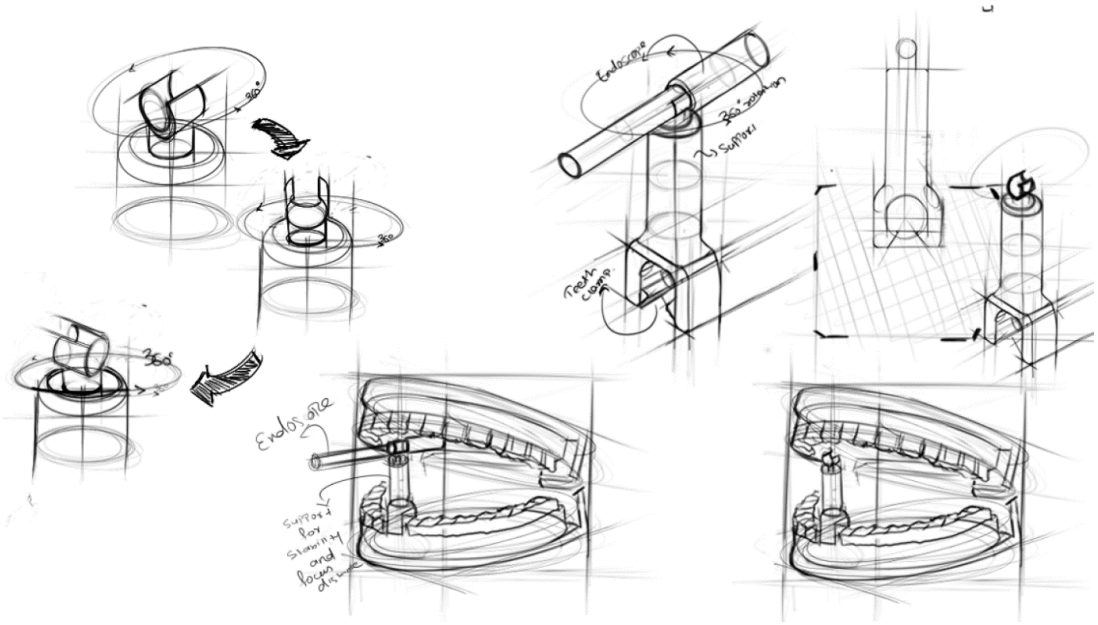


FIGURE:3.50 CONCEPT FOR ACCESSORIES
ENDOSCOPE

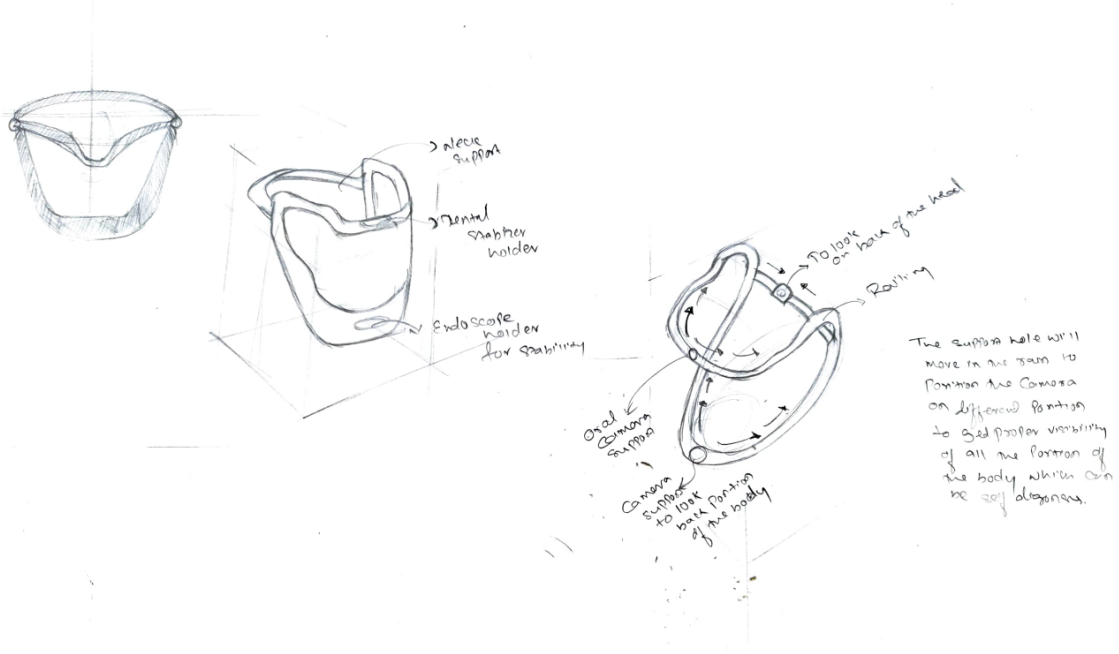
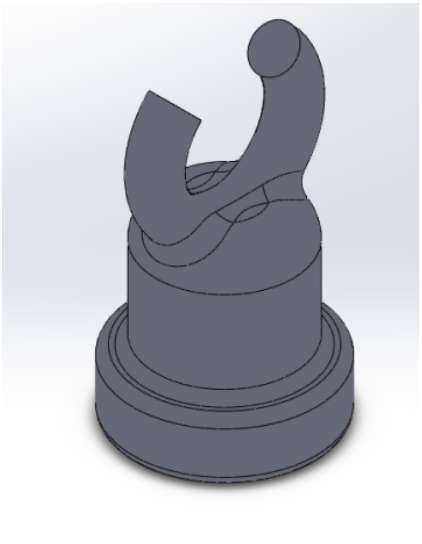


FIGURE:3.50 CONCEPT FOR ENDOSCOPE SUPPORT

3.4.3 CAD MODEL



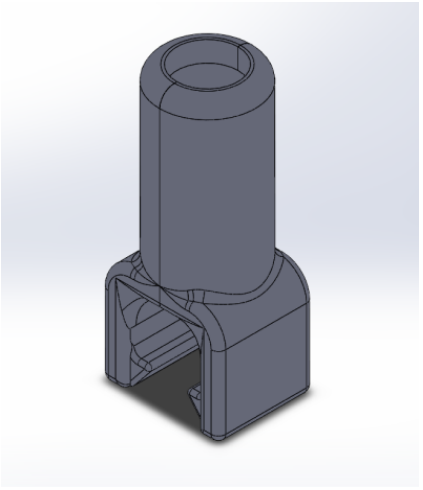


FIGURE:3.51 CAD CONCEPT FOR ACCESSORIES
ENDOSCOPE

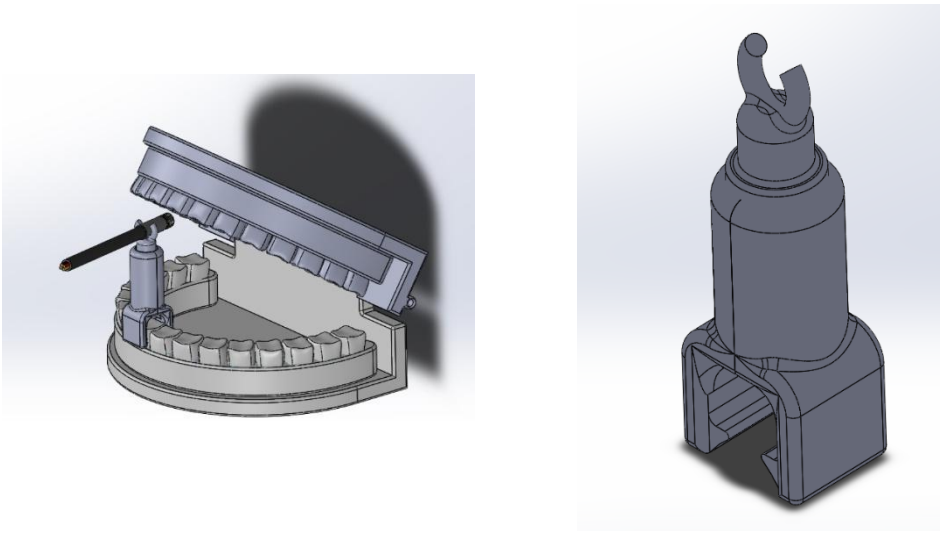


FIGURE:3.52 CAD CONCEPT FOR ACCESSORIES
ENDOSCOPE

CHAPTER 4

RESULT AND DISCUSSION

4.1 DISCUSSION

In the aforementioned experiment, several underlying problems faced by users while using an endoscope for personal use were identified. One of the challenges encountered was maintaining the camera angle to effectively observe both the front and side perspectives. This is crucial for thorough examination and diagnosis in ENT procedures.

To address this issue, a solution can be implemented to maintain the focus distance irrespective of the camera's position. This can be achieved by incorporating advanced autofocus mechanisms within the endoscope system. These autofocus systems utilize sensors and algorithms to continuously adjust the focus distance based on the position and depth of the object being observed. By automatically maintaining the optimal focus distance, users can achieve clear and accurate visualization regardless of the camera angle or position.

Moreover, providing a support system for stability can greatly enhance the usability of the endoscope. Stability is crucial in avoiding shaky or blurred images during examination. One possible approach is to design the endoscope with an ergonomic handle that offers a comfortable grip and minimizes hand movements. Additionally, incorporating a stabilization mechanism, such as an internal gyroscopic system or image stabilization technology, can further enhance stability and reduce unwanted camera movements.

In order to maintain proper focus distance and stability, the endoscope system can also be equipped with a railing guide. This guide can act as a physical support system, allowing users to slide and position the endoscope along a predefined path. The guide

ensures smooth movement and precise positioning, reducing the risk of unintended camera shifts and maintaining the desired focus distance.

To further enhance usability and convenience, a remote operating system can be implemented. This would allow users to control the endoscope automatically, reducing the need for manual adjustments and minimizing disruptions during the examination process. The remote system can include features such as adjustable camera angles, zoom capabilities, and autofocus functions. By enabling remote operation, users can have more flexibility and ease of use, while maintaining stability and focus distance throughout the ENT procedure.

Overall, incorporating advanced autofocus mechanisms, providing stability support systems, implementing railing guides, and utilizing remote operating systems can greatly enhance the usability and effectiveness of endoscopes in ENT procedures. These technological solutions aim to address the challenges faced by users, ensuring optimal visualization, stability, and focus distance during personal use of the endoscope.

4.2 RESULT

The results of implementing these technological solutions to address the challenges faced by users while using an endoscope for personal use are not explicitly mentioned in the previous information. The paragraph primarily discusses the identified problems and proposes potential solutions to maintain camera angle, focus distance, stability, and convenience during ENT procedures.

To determine the effectiveness of these solutions, further research, experimentation, and user evaluations would be necessary. These evaluations can involve testing the implemented features in real-world scenarios and gathering feedback from users, such as healthcare professionals or individuals using the endoscope for personal use. By analyzing the feedback and assessing the impact of these technological advancements, researchers can draw conclusions about the effectiveness and benefits of the proposed solutions in improving usability, stability, and focus distance maintenance in ENT procedures.

4.3 FINAL CONCEPT

FIGURE:4.1 CAD FINAL CONCEPT FOR ENDOSCOPE ACCESSORIES

FIGURE:4.2 CAD FINAL CONCEPT FOR ENDOSCOPE

FIGURE:4.3 CAD FINAL CONCEPT FOR ENDOSCOPE

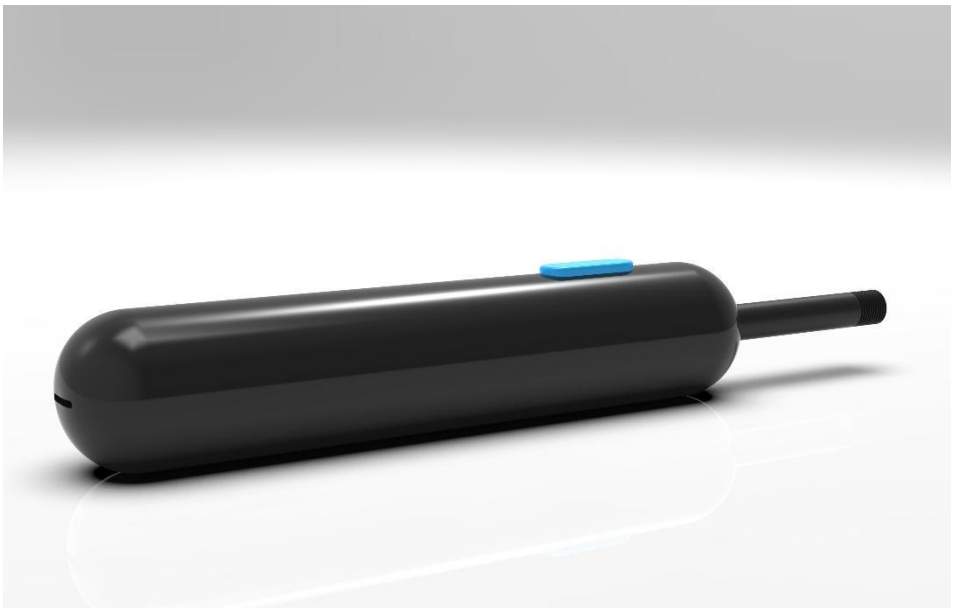


FIGURE:4.4 CAD FINAL CONCEPT FOR ENDOSCOPE

4.3 PROTOTYPE

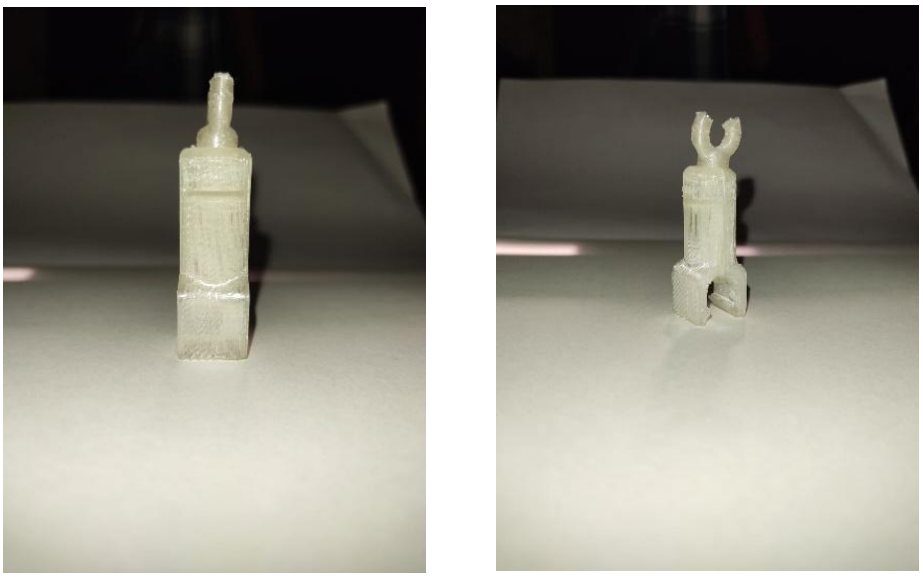


FIGURE:4.5 3-D PRINTED MODEL ACCESSORIES

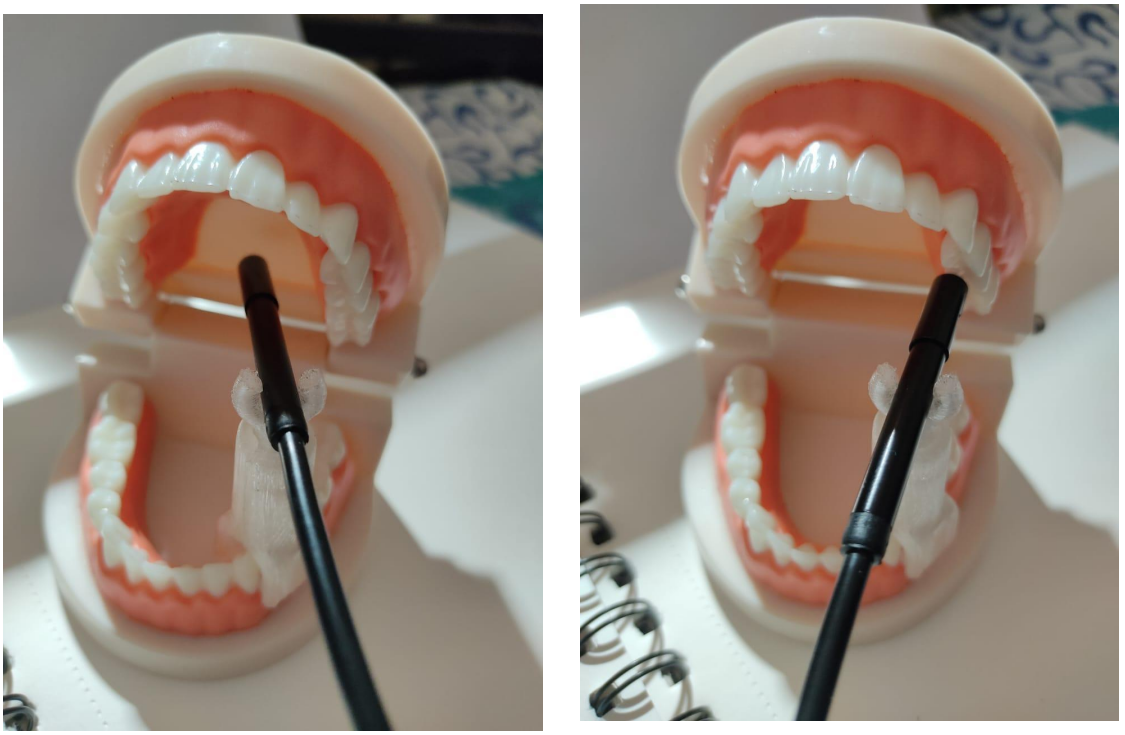


FIGURE:4.6 TESTING OF 3-D PRINTED ACCESSORIES MODEL

- **Accessories need for diagnosis different parts**

Body Parts	Device	Accessories
Ear	Endoscope	NA
Nose	Endoscope	NA
Teeth	Endoscope	Teeth Support
Throat	Endoscope	Teeth Support
Back	Endoscope	Neck Support
Back Head	Endoscope	Neck Support

Table 4.1: Accessories needed while taking Picture

CHAPTER 5

5.1 CONCLUSION

The self-diagnosis of ENT disorders is a complex area that requires further investigation. The Double Diamond design method can be employed to develop innovative solutions in this field. Additionally, endoscopic cameras hold significant potential for advancing medical practices and creating novel applications across various industries. Further research and development in both self-diagnosis tools and endoscopic technologies will contribute to improved healthcare outcomes and patient experiences.

5.2 REFERANCES

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- https://pubmed.ncbi.nlm.nih.gov/30593662/ Comparison of endoscopic and microscopic ear surgery in pediatric patients:Sang-Yoon Han , Doh Young Lee , Juyong Chung , Young Ho Kim.
- https://pubmed.ncbi.nlm.nih.gov/32310550/ OtoscopySamuelR.Falkson [1], Prasanna Tadi.
- https://ieeexplore.ieee.org/document/6076256 Smart image sensor with integrated low complexity image processing for wireless endoscope capsules. Xiaowen Li; Milin Zhang; Zhihua Wang; Amine Berrnak
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- https://www.amazon.in/MatLogix-Waterproof-Inspection-Compatible-Smartphone/dp/B0B82V8RR1/ref=sr_1_20?crid=3TMCCPI6ULBC3&keywords=endoscope+camera&qid=1685338166&sprefix=endo%2Caps%2C275&sr=8-20

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- https://www.amazon.in/Generic-Waterproof-Intraoral-Endoscope-Inspection/dp/B07QSF3SXD/ref=sr_1_12?crid=3DJPIXNGZ2CO4&keywords=oral+camera+dental&qid=1685338254&sprefix=oral+cam%2Caps%2C268&sr=8-12
- https://chat.openai.com/.