INTRODUCTION

The goal of this project is to develop a head mounted display (HMD) for surgeons to use as a navigational aid during a procedure.[1] The WINSS Augmented Reality (AR) system allows for image guided surgery without the need to occupy a surgeon's hands or eyes. Rather than providing high-resolution preoperative images, the HMD will show derived graphics and models, such as tumor outlines and target points in a "picture in picture" manner, to assist in navigation. Also, by combining the AR device with other sensors for optical tracking and inertial sensing, the system can operate even when markers are partially hidden within cavities in the area of operation.

CONSTRAINTS AND REQUIREMENTS

The proposed system must abide by the following constraints and requirements, listed in decreasing order of importance:

Picture-in-picture	:	The main goal of this project, the HMD must be able to display the desired images in a picture-in-picture format
Able to display from PC software	:	Display must be able to port views and representations from
Inexpensive	:	~$1000 budget
Field of view	:	HMD must minimally restrict field of view, without creating tunnel vision or distortion of normal vision
Comfortable	:	HMD must be easy to wear, without restricting normal range of motion required for surgery
Inertial measurement unit	:	Measurement of motion of head, specifically orientation and movement
Microphone	:	Allow for audio input and output, for voice commands and audio feedback to surgeon
Camera	:	Allow for recording of operation and future implementation of overlay

[1] https://smarts.lcsr.jhu.edu/dokuwiki/doku.php?id=research#wearableintelligentnavigationsystemforsurgerywinss

ANALYSIS OF AVAILABLE OPTIONS

	Google Glass[2]	**Vuzix M100[3]**	**Epson Moverio BT-200[4]**
Cost	$1500	$999 $199 for developer kit	$699
Developer environment	Android SDK with GDK add-on	Android SDK	Android SDK
Capable of picture-in-picture	Yes	Yes	AR display in center of FOV
Able to display from PC software	Pairs with smartphone	Pairs with Android device. Can mirror displays.	Pairs with provided Android handset/touchpad. Can mirror displays.
Field of view (FOV)	AR display in top of right eye FOV	14° AR display in right eye FOV	23° AR display in center of FOV
Comfortable	Glasses-like, wearable headset	Over-ear headset	Glasses-like wearable headset
Inertial measurement unit	Integrated gyroscope and accelerometer	3 DOF head tracking Integrated compass and GPS	Integrated gyroscope, accelerometer, and compass.
Microphone	Yes	Yes	Yes
Camera	Single camera	Single camera	Single camera
Comments	Bone conduction transducer for audio feedback to user	Bluetooth, Wi-Fi connectivity.	Bluetooth, Wi-Fi connectivity. Wearable over glasses.

[2] https://support.google.com/glass/answer/3064128?hl=en
[3] http://www.vuzix.com/consumer/products_m100/
[4] http://www.epson.com/cgi-bin/Store/jsp/Product.do?sku=V11H560020&BV