

Petition for *Inter Partes* Review of
U.S. Patent No. 8,982,109 B2

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

META PLATFORMS, INC., INSTAGRAM, LLC, WHATSAPP INC.,
Petitioners

v.

EYESMATCH LTD., MEMOMI LABS INC.,
Patent Owners

Case IPR2022-00489

U.S. Patent No. 8,982,109 B2
Issue Date: March 17, 2015

Title: Devices, Systems and Methods of Capturing and
Displaying Appearances

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 8,982,109 B2**

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List of Exhibits

Exhibit No.	Description of Document
1001	U.S. Patent No. 8,982,109 B2 to Nissi Vilcovsky and Ofer Saban (filed March 15, 2013, issued March 17, 2015) (“’109” or “’109 patent”)
1002	Declaration of Chandrajit Bajaj, Ph.D. (“Bajaj”)
1003	U.S. Patent App. Pub. No. US 2007/0040033 A1 to Louis B. Rosenberg (filed September 26, 2006, published February 22, 2007) (“Rosenberg”)
1004	Excerpts from 2003 International Conference on Multimedia and Expo, ICME ’03 Proceedings, including Alexandre R.J. Francois et al., <i>A Handheld Mirror Simulation</i> (2003) (“Francois”)
1005	U.S. Patent No. 8,587,653 B1 to Joseph Vidunas et al. (filed April 30, 2010, issued November 19, 2013) (“Vidunas”)
1006	U.S. Patent No. 6,512,541 B2 to Randy R. Dunton et al. (filed December 8, 1997, issued January 28, 2003) (“Dunton”)
1007	U.S. Patent No. 8,264,587 B2 Sinhung Yong et al. (filed January 15, 2009, issued September 11, 2012) (“Yong”)
1008	U.S. Patent No. 8,264,573 B2 to Toshihiko Suzuki (filed May 11, 2010, issuing September 11, 2012) (“Suzuki”)
1009	U.S. Patent Application Ser. No. 13/088,369 to Nissi Vilcovsky (filed April 17, 2011, issuing as U.S. Patent No. 8,624,883)
1010	U.S. Patent Application Ser. No. 11/817,411 to Nissi Vilcovsky (PCT filed March 1, 2006, issuing as U.S. Patent No. 7,948,481)

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Exhibit No.	Description of Document
1011	Redline comparison of U.S. Patent Application Ser. No. 13/088,369 to Nissi Vilcovsky (Ex. 1009) with written description of '109 patent
1012	Excerpts from <i>Joint Claim Construction Chart</i> filed on November 16, 2021 in <i>EyesMatch Ltd. et al., v. Facebook, Inc. et al.</i> , No. 1:21-cv-00111 RGA (JLH) (D. Del.)
1013	Excerpts from <i>Microsoft Computer Dictionary</i> (5th ed. 2002)
1014	Excerpts from Julie Adair King et al., <i>Digital Photography for Dummies</i> (6th ed. 2009)
1015	Excerpts from Brad Hansen, <i>Dictionary of Multimedia</i> (1998)
1016	Excerpts from Dick Pountain, <i>New Penguin Dictionary of Computing</i> (2001)
1017	Proof of Service of Complaint in <i>EyesMatch Ltd. et al. v. Facebook, Inc. et al.</i> , Case No. 1:21-cv-00111-RGA-JLH (D. Del.)
1018	Excerpts from Initial Infringement Contentions of Plaintiffs EyesMatch Ltd. and Memomi Labs Inc. in <i>EyesMatch Ltd. et al. v. Facebook, Inc. et al.</i> , Case No. 1:21-cv-00111-RGA-JLH (D. Del.)
1019	Defendants' Preliminary Disclosure of Proposed Claim Constructions and Identification of Intrinsic Evidence in <i>EyesMatch Ltd. et al. v. Facebook, Inc. et al.</i> , Case No. 1:21-cv-00111-RGA-JLH (D. Del.)
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1021	Scheduling Order in <i>EyesMatch Ltd. et al. v. Facebook, Inc. et al.</i> , Case No. 1:21-cv-00111-RGA-JLH (D. Del.)

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Exhibit No.	Description of Document
1022	Declaration of Sylvia D. Hall-Ellis, Ph.D. (“Hall-Ellis”)
1023	Prosecution History of U.S. Patent No. 8,982,109 B2
1024	Excerpts from EyesMatch Ltd.’s and Memomi Labs Inc.’s Objections and Responses to Defendant’s First Set of Interrogatories (Nos. 1-4)
1025	Excerpts from email correspondence between counsel, including email regarding claim construction for ’109 patent dated December 17, 2021 from N. Saputo
1026	Excerpts from Proceedings of the International Society for Optical Engineering (SPIE), Multimedia Networks: Security, Displays, Terminals, and Gateways, Nov. 4-5, 1997, including Stefan Agamanolis et al., <i>Reflection of Presence: Toward More Natural and Responsive Telecollaboration</i> (“Agamanolis”)
1027	U.S. Patent No. 6,811,492 B1 to Minoru Arakawa et al. (filed November 28, 2000, issued November 2, 2004) (“Arakawa”)

I. MANDATORY NOTICES UNDER §42.8(A)(1)

A. Real Party-In-Interest under §42.8.(b)(1)

Meta Platforms, Inc., Instagram, LLC, and WhatsApp Inc. (collectively the “Petitioner”) are the real parties-in-interest to this IPR petition.

B. Related Matters under §42.8(b)(2)

The ’109 patent is the subject of pending litigation involving Petitioner: *EyesMatch Ltd. et al. v. Facebook, Inc. et al.*, Case No. 1:21-cv-00111-RGA-JLH (D. Del.). Petitioner was first served on January 29, 2021. (Ex. 1017, 002.)

On December 30, 2021, Petitioner filed IPR petitions with respect to U.S. Patent Nos. 7,948,481 (IPR2022-00370) and 8,624,883 (IPR2022-00371), the parent patents of the ’109 patent.

C. Lead and Back-Up Counsel under §42.8(b)(3)

Petitioner provides the following designation of counsel.

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D. Service Information

This Petition is being served by Federal Express to the attorney of record for the '109 patent, Womble Bond Dickinson (US) LLP, ATTN: IP Docketing, P.O. Box 7037, Atlanta GA 30357-0037. Petitioner consents to electronic service at the addresses provided above for lead and back-up counsel.

II. FEE PAYMENT

Petitioner requests review of 6 claims, with a \$41,500 payment.

III. REQUIREMENTS UNDER §§ 42.104 AND 42.108 AND CONSIDERATIONS UNDER §§ 314(A) AND 325(D)

A. Grounds for Standing

Petitioner certifies that the '109 patent is available for IPR and that Petitioner is not barred or otherwise estopped.

B. Identification of Challenge and Statement of Precise Relief Requested

Petitioner requests IPR institution based on:

Ground	Claims	Basis for Challenge under §103
1	1-2, 6, 8-9, 17	Obvious over Rosenberg [Ex. 1003] in view of Francois [Ex. 1004], Vidunas [Ex. 1005], Dunton [Ex. 1006] and Yong [Ex. 1007]
2	1-2, 6, 8-9, 17	Obvious over Rosenberg in view of Francois, Vidunas, and Suzuki [Ex. 1008]

Submitted with this Petition is the Declaration of Chandrajit Bajaj, Ph.D. (Ex. 1002) (“**Bajaj**”), a qualified technical expert. (Bajaj, ¶¶1-15, Ex. A.)

C. Considerations Under §§ 314(a) and 325(d)

§314(a): Neither the *General Plastic* nor the *Fintiv* factors favor discretionary denial under § 314(a). As to *General Plastic*, this is the first IPR petition filed by Petitioner (or anyone). Petitioner is unaware of other post-grant challenges (*e.g.* reexaminations) filed against the '109 patent.

As to *Fintiv*, the pending district court litigation is in early stages. Trial is not scheduled to begin until October 2023. (Ex. 1021.) Petitioner intends to move to

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stay the litigation pending IPR. The parties have exchanged proposed claim constructions for certain terms (Exs. 1012, 1019-1020), but the Court has not issued any claim construction rulings. Petitioner served initial invalidity contentions in the district court, but to mitigate concerns regarding duplicative efforts, Petitioner will not pursue invalidity of the '109 patent in the litigation based on any instituted ground in this proceeding.

§325(d): The grounds listed in **Part III.B** above cite to and rely on Francois (Ex. 1004), Vidunas (Ex. 1005), Dunton (Ex. 1006), Yong (Ex. 1007) and Suzuki (Ex. 1008), none of which was cited during prosecution of the '109 patent.

Rosenberg (Ex. 1003) was cited on an applicant-submitted Information Disclosure Statement (IDS) but was never the subject of any rejection. *See, e.g., Cellco Partnership v. Huawei*, IPR2020-01117, Paper 10 at 13 (P.T.A.B. Feb. 3, 2021) (“[T]he fact that Wen was not the basis of rejection weighs strongly against exercising our discretion to deny institution under 35 U.S.C. § 325(d).”). There were, in fact, no rejections during prosecution of the '109 patent as the Examiner allowed the claims in the first Office Action dated December 5, 2014. (Ex. 1023, 0077-0081.) It was not until after the Examiner issued the Notice of Allowability that the applicant submitted Rosenberg on an IDS. (Ex. 1023, 0035, 0054.)

Even if the Examiner had used Rosenberg as the basis for a rejection (which he did not), it would still raise no §325(d) concerns because Petitioner combines it

with other references that were not cited during prosecution. *See, e.g., Oticon Medical v. Cochlear*, IPR2019-00975, Paper 15 at 20 (P.T.A.B. Oct. 16, 2019) (precedential) (declining to deny IPR institution under §325(d) where petition presented one new and noncumulative reference). For example, all grounds listed in **Part III.B** rely on Francois for several limitations of claim 1 including at least **“applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror”** (claim 1[c]), and **“resizing the image to reduce variations caused by changes in object’s distance to the camera”** (claim 1[d]) and **“determining distance to a user appearing in the live video feed”** (claim 1[g]). The Petition also cites Vidunas for claim 1[d]. And for the step of **“varying rate at which the non-ordered steps are performed on the series of images according to the distance”** (claim 1[h]), the Petition relies on new references Dunton and Yong for Ground 1, and Suzuki for Ground 2.

Accordingly, because the Examiner never relied on Rosenberg as the basis for any rejection, and because all grounds rely on new prior art that was not cited during prosecution, §325(d) concerns are not implicated.

IV. OVERVIEW OF THE '109 PATENT

A. Level of Ordinary Skill in the Art

A person of ordinary skill would have possessed at least a bachelor’s degree in electrical engineering or computer science, and two years of work experience

related to image capture and processing, and would also have familiarity with 3-D graphics programming and/or computer vision. A person could qualify with more formal education and less technical experience, or vice versa. (Bajaj, Ex. 1002, ¶¶18-24.)

B. Specification Overview

The '109 patent states that it “relates generally to imaging and display systems and, more particularly, to monitors, and interactive displays, e.g., in retail and/or service environments, medical or home situations, video conferencing, gaming, etc.” ('109, 1:26-29.) More specifically, the '109 patent discloses implementations for making a computer-based flat panel display behave like a conventional reflective mirror. ('109, *e.g.*, 1:29-31.) Figure 6 illustrates one embodiment:

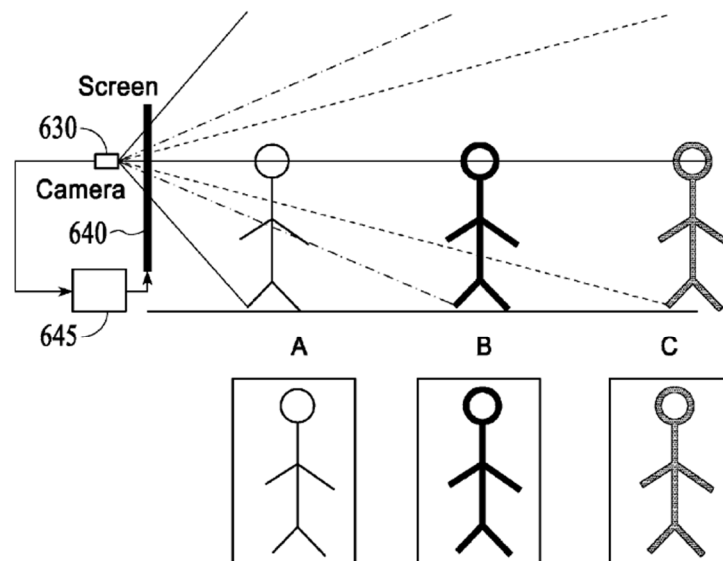


FIG. 6

('109, Fig. 6, 14:13-29.) As shown in Figure 6 above, a standard mirror has been

replaced with a digital screen **640** that displays images captured by camera **630** after processing by computerized image processor **645**.

The patent acknowledges that replacing a conventional mirror with a camera and screen was not new, but contends that prior art techniques do not provide a convincing or reliable mirror-like image. ('109, 1:61-2:3, 2:4-48.) The patent purports to address these issues by digitally manipulating the image captured by camera such that, when displayed on screen, it resembles an image the user would have seen if the screen was actually a standard mirror. ('109, *e.g.*, 14:6-17:54.)

V. CLAIM CONSTRUCTION

Petitioner does not believe any express claim construction is necessary at this time for this IPR. As noted in **Part VI** below, although Petitioner and Patent Owner have offered competing constructions in the pending litigation for certain terms (Ex. Ex. 1012, 003-004), the prior art discloses those limitations under either side's proposed constructions or any reasonable construction. (Bajaj, ¶31.)

VI. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Overview of Grounds

The '109 patent attempts to lay claim to techniques of displaying digital images of a person that mimic appearance of the user in a mirror. But this was known in the prior art. The challenged grounds below rely on **Rosenberg** (Ex. 1003), which discloses a remarkably similar system for capturing digital images of

a user and transforming them so they simulate the appearance of the user in a conventional reflective mirror. (Rosenberg, *e.g.*, ¶0077; Bajaj, ¶53.) The techniques in Rosenberg include both flipping captured images left-right and scaling them such that they “appear[] like a traditional life-size mirror image.” (Rosenberg, ¶0077.) Petitioner relies on Rosenberg in combination with Francois (Ex. 1004), which discloses yet another similar system for simulating a mirror appearance, but provides more detail about how images are digitally transformed to provide a convincing mirror simulation. (Bajaj, ¶¶55-57; Francois, 0021-0023.)

The disclosures in Rosenberg and Francois disclose most of the limitations in the challenged claims. The proposed grounds also cite to Vidunas (Ex. 1005) for well-known techniques for “cropping” digital images, which would have been familiar to ordinarily skilled artisans or even laypersons who used photo editing tools on mobile phones. (Bajaj, ¶¶60-64; Vidunas, Fig. 6.)

The remaining references are cited for the final limitation of claim 1, “**varying rate at which the non-ordered steps are performed on the series of images according to the distance.**” For this limitation, **Ground 1** cites Dunton (Ex. 1006) and Yong (Ex. 1007), which disclose the ability to increase the frame rate for a video by decreasing the amount of data in the frames of the video. (Bajaj, ¶¶65-71; Dunton, 1:35-43; Yong, 4:25-32.) **Ground 2** cites Suzuki (Ex. 1008), which renders

obvious the ability to increase video frame rate to more accurately capture close-up images. (Bajaj, ¶¶72-76; Suzuki, 13:52-64.)

B. Priority Date and Prior Art Status

The '109 patent issued from an application filed on March 15, 2013, as a continuation-in-part (CIP) to an application filed on April 17, 2011, which in turn was a continuation to an application filed on March 1, 2006. (Ex. 1001, Face page.) The '109 patent also claims priority to a provisional filed on December 18, 2012. In the pending litigation, Patent Owner has only claimed priority based on the December 18, 2012 provisional – not the earlier applications. (Ex. 1024, 003.)

Federal Circuit law is clear that Patent Owner would bear the burden to show that the challenged claims are entitled to a priority date based on the April 17, 2011 and March 1, 2006 applications. *See, e.g., PowerOasis, Inc. v. T-Mobile USA, Inc.*, 522 F.3d 1299, 1305 (Fed. Cir. 2008). Petitioner is unaware of any attempt by Patent Owner to make such a claim, nor would it have any basis to make one. The CIP application filed on March 15, 2013 added extensive new matter not present in the previous applications, including disclosures essential to multiple claim limitations. (Bajaj, ¶¶77-79 & Ex. 1011 (showing redline comparison).) The challenged claims should thus be afforded a priority date of no earlier than December 18, 2012.

Rosenberg and Dunton qualify as prior art to the '109 patent under at least § 102(b) (pre-AIA) because they were patent references published more than one

year before December 18, 2012. Vidunas, Yong and Suzuki qualify under at least § 102(e) (pre-AIA) because they are patents issuing from applications filed before the priority date. And Francois qualifies as a printed publication under at least § 102(b) (pre-AIA). (Hall-Ellis, Ex. 1022, ¶¶42-48.)

C. Ground 1: Claims 1, 2, 6, 8, 9 and 17 Are Obvious Over Rosenberg in View of Francois, Vidunas, Dunton and Yong

1. Claim 1

- (a) **“A method for operating a system having a monitor, a camera, and a processor, so as to display a mirror-mimicking image on the monitor, by performing non-ordered steps comprising:” (Claim 1[pre])**

To the extent the preamble is limiting, the prior art discloses it. Rosenberg discloses a “digital mirror system...adapted to provide real-time captured images that approximate what a user would see when viewing an ordinary mirror.” (Rosenberg, ¶0006; *see also id.*, ¶0025, claim 1.) The system includes **a monitor**, **a camera**, and **a processor**, as Rosenberg diagrams:

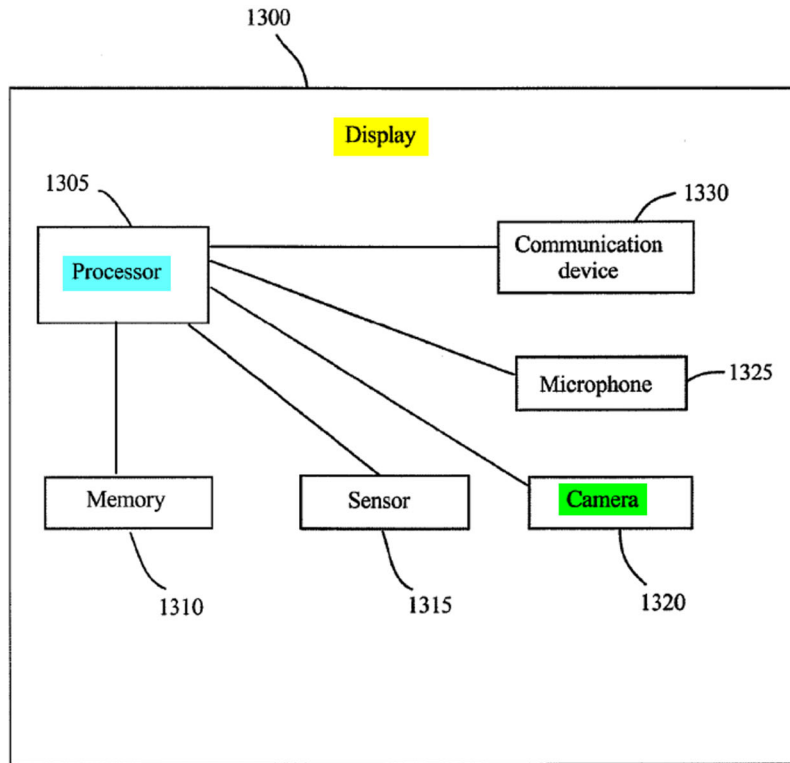


Fig. 13

(Rosenberg, Fig. 13; *see also id.*, ¶0109.) These components are also shown in Figure 3, below, which shows an embodiment of the system having camera 302 mounted above screen area of display 301:

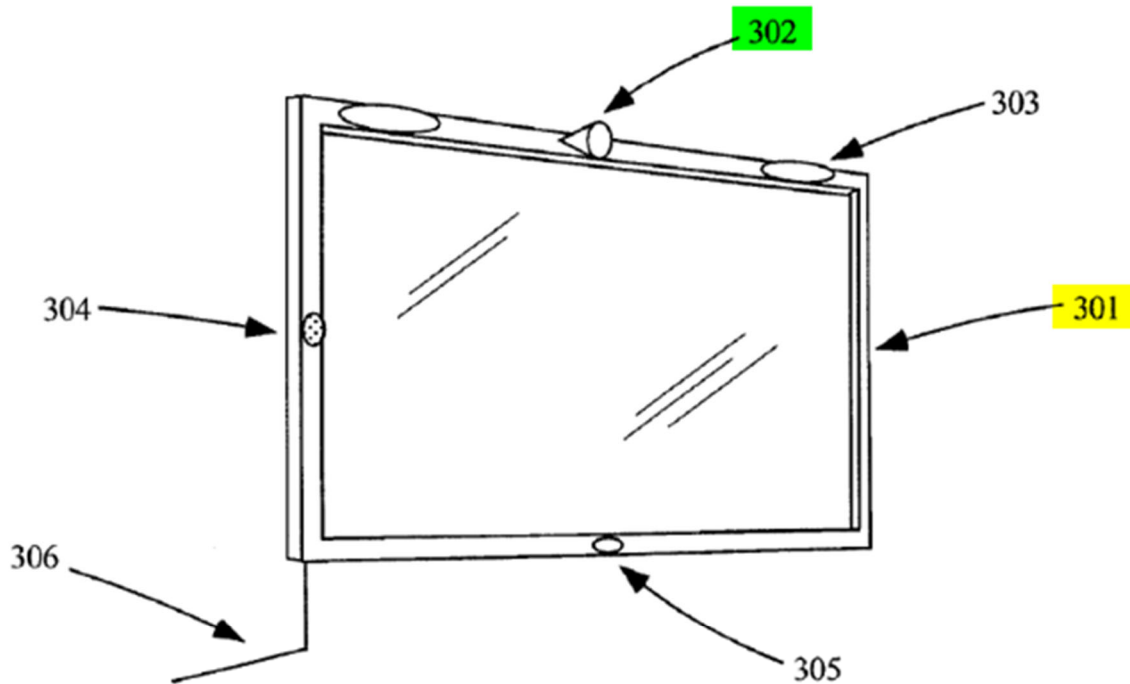


Fig. 3

(Rosenberg, Fig. 3; Rosenberg, ¶0062.) Rosenberg therefore discloses “**a system having a monitor, a camera, and a processor,**” as recited.

Rosenberg further discloses a method for operating its system “**so as to display a mirror-mimicking image on the monitor.**” This is illustrated in Figure 5, below, which shows a user seeing what the user would see if standing before a traditional optical mirror:

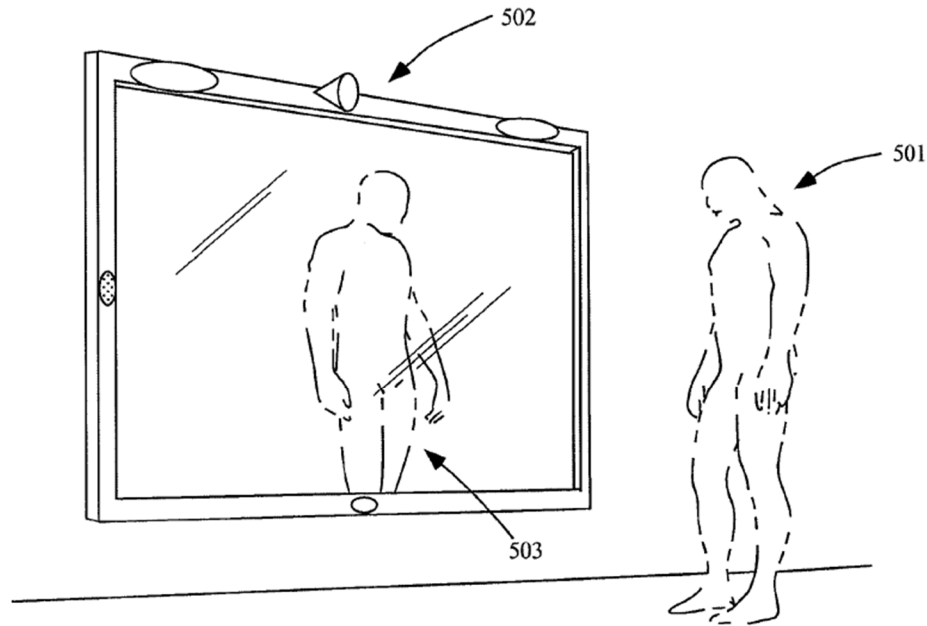


Fig. 5

(Rosenberg, Fig. 5.)

Referring to Figure 5 above, Rosenberg explains that the digital mirror system **502** captures real-time video images and then transforms them so they appear, when displayed, like traditional life-size mirror images:

FIG. 5 illustrates a computer rendering of a human user **501** standing in front of a wall-mounted embodiment... The user's image is captured as a real-time video image by a camera upon or within the digital mirror **502** as described previously. A representation of that real-time video image is then displayed upon the wall mounted screen of the digital mirror 502 with a displayed size and scaling such that it appears like a traditional life-size mirror image 503. In a traditional mirror emulation mode, the real-time video image is left-right inverted prior to display upon the screen. Thus the user 501 standing before the digital display

is given the visual impression that he or she is standing before a traditional wall mirror, viewing a traditional mirror image of himself or herself.

(Rosenberg, ¶0077.)¹ Rosenberg therefore discloses a method of operating its digital mirror system “**so as to display a mirror-mimicking image on the monitor.**”

Petitioner notes that the parties in the pending litigation stipulated that “**mirror-mimicking image**” means an image that “*mimics the image that would have been reflected from a mirror, i.e., from a reflective surface.*” (Ex. 1025; Ex. 1012, 006.) Rosenberg clearly discloses a “**mirror-mimicking image**” under this construction, or any other reasonable construction, because it discloses an image providing “the visual impression that [the user] is standing before a traditional wall mirror, viewing a traditional mirror image of [the user]” (Rosenberg, ¶0077). Rosenberg’s reference to a “traditional wall mirror” discloses a conventional mirror with a reflective surface. (Bajaj, ¶83 (citing Rosenberg, *e.g.*, ¶0003 (“At its core, a typical household mirror is operative to reflect an image of a user, enabling that user to view himself or herself when standing before it.”))).) Rosenberg therefore discloses a method for operating a system having a monitor, a camera, and a processor, “**so as to display a mirror-mimicking image on the monitor.**”

¹ Except as otherwise noted, all underlining in quotations was added for emphasis.

Rosenberg alone sufficiently discloses the preamble, but **Ground 1** also cites to Francois, Vidunas, Dunton, and Yong, to disclose the details of the method steps that follow the preamble. As shown below in the discussion of limitation 1[c], which recites applying a transformation mapping such that an image “**appears to mimic a reflection of a mirror,**” the display of a “**mirror-mimicking image**” would also have been obvious over Rosenberg in view of Francois and Vidunas. As demonstrated below, the claimed method (with all of its steps), is rendered obvious by the proposed combination of Rosenberg, Francois, Vidunas, Dunton and Yong.

Finally, the preamble concludes by reciting, “**by performing non-ordered steps comprising,**” with the term “**non-ordered steps**” also repeated in limitation 1[f] (*i.e.* “**wherein the non-ordered steps are performed on a series of images of a live video feed from the camera**”). As explained in detail for limitation 1[f], “**non-ordered steps**” is the subject of a dispute in district court with Petitioner arguing that the term renders the claim indefinite. But as explained below, this issue presents no obstacle to IPR. (Bajaj, ¶¶134-135, ¶31 fn.1.)

(a) “obtaining a digital image from a camera;” (Claim 1[a])

Rosenberg discloses obtaining a digital image from a camera, *e.g.*, when a user stands in front of the digital mirror device:

[E]mbodiments of the present invention provide a wall-mounted flat panel display and one or more digital camera(s) configured to provide real-time images of a user who stands before the display. In a traditional

mirror mode of an embodiment of the present invention, the real-time images are streamed video images captured by a camera mounted upon the display, the real-time streamed video images being a left-right inverted representation of the video signal captured by the camera.

(Rosenberg, ¶0026; *see also id.*, e.g., ¶¶0055 (“...image data collected in real-time from a camera aimed at the person or persons standing before the screen at that real time and thereby replicating the function of a real mirror.”), 0006 (“A camera captures the at least one image.”), 0038; Bajaj, ¶¶85-86.) Rosenberg therefore discloses “**obtaining a digital image from a camera.**”

(b) “flipping the image about a vertical axis so as to reverse right and left sides of the image;” (Claim 1[b])

Rosenberg discloses this feature by describing how the captured digital image is inverted left-to-right along its vertical axis:

In a traditional mirror mode of an embodiment of the present invention, the real-time images are streamed video images captured by a camera mounted upon the display, the real-time streamed video images being a left-right inverted representation of the video signal captured by the camera. This left-right inverted representation is generally produced by flipping the pixels of the image around the vertical centerline such that right side of the user, from the user’s perspective, appears upon the right side of the display, and the left side of the user, from the user’s perspective, appears upon the left side of the display... This left-right inversion process is performed to present the user with a traditional mirror image view of himself or herself, inverted in a similar was as

would be seen in a traditional optical mirror.

(Rosenberg, ¶0026; *see also id.*, ¶¶0035, 0077; Bajaj, ¶86.)

An ordinarily skilled artisan would have understood Rosenberg’s disclosure of “flipping the pixels of the image around the vertical centerline” (Rosenberg, ¶0026), to disclose “**flipping the image about a vertical axis**,” as claimed, because “the vertical centerline” is a vertical axis. (Bajaj, ¶86.) Rosenberg also discloses flipping so as to “**reverse right and left sides of the image**.” This is because the flipping, as Rosenberg explains, causes the “right side of the user, from the user’s perspective, [to] appear[] upon the right side of the display, and the left side of the user, from the user’s perspective, [to] appear[] upon the left side of the display.” (Rosenberg, ¶0026.) This is the **reverse** of what someone would see in a non-flipped digital image of themselves (*i.e.*, the right side of the image shows the left side of the user, and vice versa). (Bajaj, ¶86.)

(c) “**applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror;**” (Claim 1[c])

As noted, Rosenberg describes techniques for providing “the visual impression that [a person] is standing before a traditional wall mirror, viewing a traditional mirror image of himself or herself.” (Rosenberg, ¶0077; *see also, e.g., id.*, ¶0006.) In addition to flipping captured images (as discussed above), Rosenberg discloses that the system also applies “scaling such that [the image] appears like a

traditional life-size mirror image.” (Rosenberg, ¶0077.) But Rosenberg does not provide details about how its system performs the scaling and other transformations (beyond flipping the image) to mimic a mirror reflection.

Petitioner has therefore cited Rosenberg in combination with **Francois** for limitation 1[c]. Francois discloses a system similar to Rosenberg for mimicking a mirror appearance, but Francois provides far more details about how images are digitally transformed to create a simulated mirror appearance.

Francois discloses “a handheld mirror simulation device.” (Francois, 0021, Abstract.) Figure 1 of Francois illustrates the system:

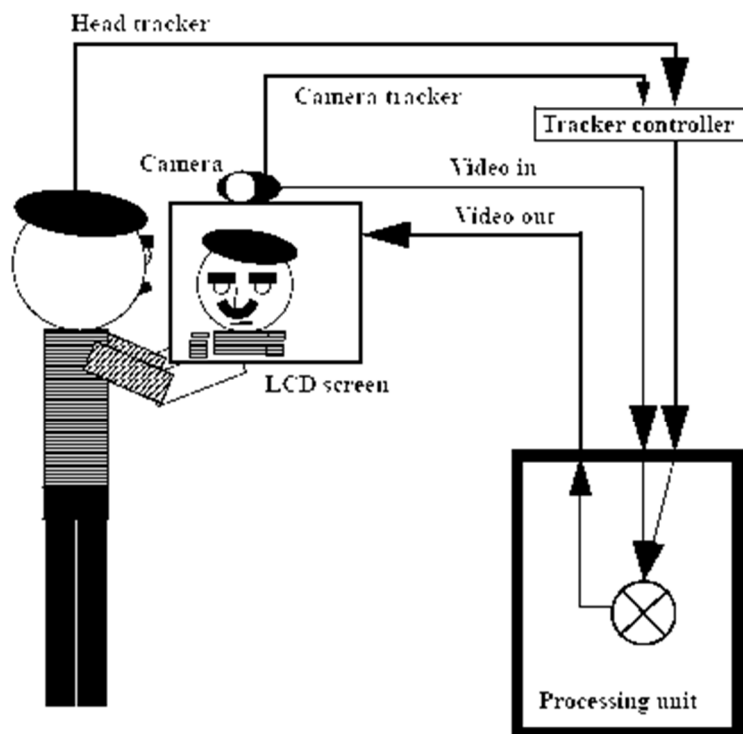


Figure 1. Handheld mirror simulation system.

(Francois, Fig. 1, 0021.) The system as shown includes an LCD screen and camera.

(*Id.*) Real-time video from the camera is fed into a processing unit, which outputs processed video to the LCD screen. (Francois, 0023, System Integration.) The system as shown above also includes a “Head tracker” and “Camera tracker,” which provide real-time positional data needed to transform the video images from the perspective of the camera to the user’s perspective. (Francois, 0023, System Integration; *see also id.*, 0021 (“The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen.”).) The output video, as noted, “is a close approximation of what the user would see on the screen surface if it were a real mirror.” (Francois, 0021, Introduction; *see also id.*, 0023 (“The result is a convincing handheld mirror simulation”).)

Francois recognizes that a digital camera will not necessarily capture the same view as the person would see in a conventional mirror because of differences in the point of view between the user and the camera. (Francois, 0021, Introduction.) As discussed below, to create a simulated mirror appearance, Francois describes image transformations that fully disclose the claimed “**transformation mapping**.”

The image transformation process in Francois generally involves three steps. First, Francois describes a process of mathematically determining the viewpoint of the user who is standing in front of the mirror-display device. Francois explains that the image formed by the mirror can be described by the following equations, where

d is the user's (and virtual viewpoint's) distance from the mirror:

$$\begin{bmatrix} U_p \\ V_p \\ W_p \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1/d & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} \quad \begin{aligned} x_p &= U_p/W_p = dx/z \\ y_p &= V_p/W_p = dy/z \end{aligned}$$

(Francois, 0022, Mirror geometry.) These equations map an object's real-world coordinates (x, y, z) to the mirror plane coordinates (x_p, y_p) using a projection matrix that would have been familiar to any undergraduate student taking an introductory course in 3-D computer graphics or computer vision. (Bajaj, ¶92.)

The second step is to determine the viewpoint of the camera used to capture the image of the user. Francois explains that “[a] camera whose position and orientation are fixed with respect to the mirror produces a video stream that corresponds to this particular viewpoint.” (Francois, 0022, Pinhole camera geometry.) Francois diagrams the camera's view in Figure 3:

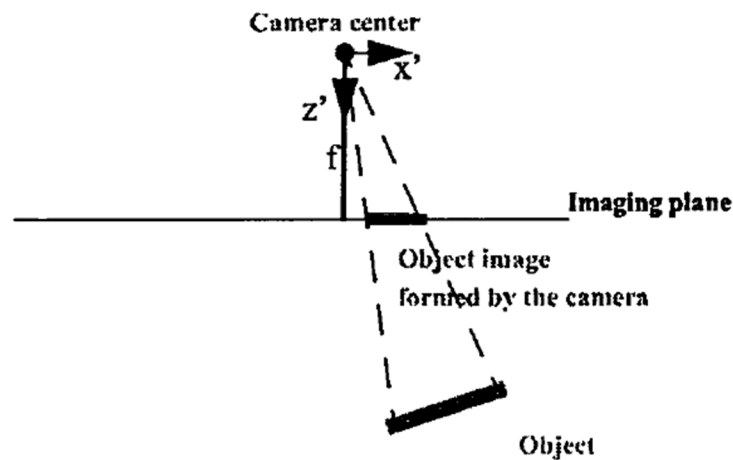


Figure 3. Pinhole camera geometry.

(*Id.*) As shown in the figure above, the camera center (i.e., the lens) is distance f —the lens’s focal length—from the imaging plane where the image of the object is formed. To this end, Francois discloses equations for mapping the camera’s view to the real world:

$$\begin{bmatrix} U_p \\ V_p \\ W_p \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1/f & 0 \end{bmatrix} \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} \quad \begin{aligned} x'_p &= U_p / W_p = fx' / z' \\ y'_p &= V_p / W_p = fy' / z' \end{aligned}$$

(*Id.*) These equations are similar to the equations described in the first step for relating a user’s view to the real world, except that for this second step, the equations use the camera’s focal length f instead of the user’s distance d —in essence simply replacing the mirror plane with the camera’s imaging plane. (Bajaj, ¶¶94-95.)

The third step of Francois brings together the results of the first two steps, in order to “synthesize the images corresponding to the user’s viewpoint from the image captured by the camera” (Francois, 0022, User view synthesis.) “We place the camera so the image plane and (virtual) mirror planes coincide.” (*Id.*) Putting everything together, Francois provides “[t]he transformation equations that relate the user’s view to the camera image,” shown below:

$$\begin{aligned} x_p &= d((f+d)x'_p/f + t_x)/((f+d) + t_z) \\ y_p &= d((f+d)y'_p/f + t_y)/((f+d) + t_z) \end{aligned}$$

(Francois, 0023.) Francois explains that the three parameters in the transformation

equations above are: (1) the focal length f , (2) the distance to the user d , and (3) the translation parameters t_x , t_y , t_z , which are used to align the camera image plane and mirror plane. (*Id.*; Bajaj, ¶96.) As a result of applying this transformation, “[t]he major field-of-view variations occurring [sic] when varying the angle of view and distance to the mirror, are convincingly simulated.” (*Id.*)

The transformation process in Francois thus discloses **“applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror.”** This is because the transformation equations above transform the image from the camera’s view to the user’s view, in order to provide “a close approximation of what the user would see on the screen surface if it were a real mirror.” (Francois, 0021.) The mirror transform step is also depicted in the flowchart in Francois (annotated by Petitioner):

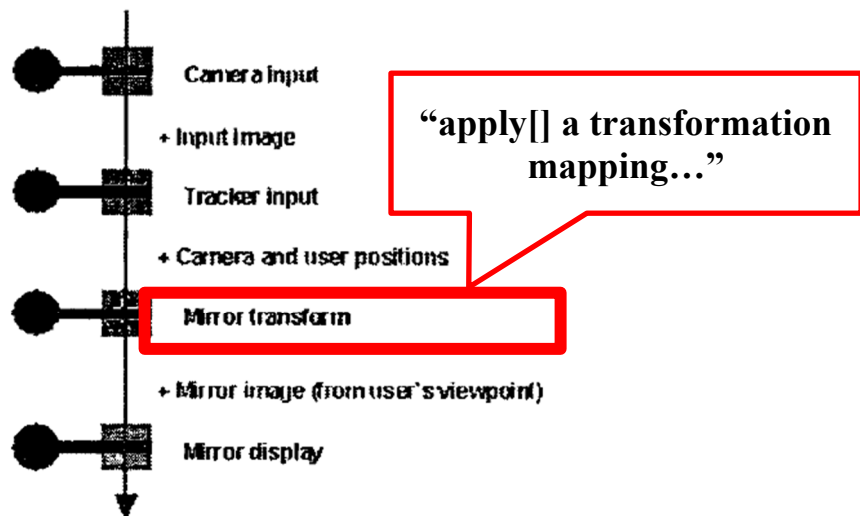


Figure 6. Mirror simulation application graph.

(Francois, Fig. 6, 0023 (annotation added).) Francois thus discloses a transformation mapping that modifies the captured video images such that they appear to mimic a reflection of a mirror.

As noted, the parties in the pending litigation stipulated that the claim phrase, **“appears to mimic the reflection of a mirror,”** means that the images appear to *“mimic the image that would have reflected from a mirror, i.e., from a reflective surface.”* (Ex. 1025; Ex. 1012, 006.) Francois satisfies this interpretation (or any other reasonable construction) because the purpose of its transformation mapping is *“to simulate a real mirror on a computer screen.”* (Francois, 0021, Introduction).

That Francois discloses the claimed transformation mapping is further confirmed by the fact that the transformations in Francois are similar to those later-disclosed in the '109 patent. For example, Francois explains that “the transform relating the user’s view to the camera view is reduced to a scaling and a translation” (Francois, 0023) – two types of image manipulations that the '109 patent expressly identifies as examples of transformation mapping. ('109, 29:30-40.) And in describing the claimed transformation mapping, the '109 patent explains that “[p]erforming an adaptive POV [point of view] and adaptive FOV [field of view] prior to displaying the image on the screen results in an image that mimics a reflection of a mirror positioned at the location of the screen.” ('109, 15:59-16:5; *see also id.*, 2:4-48.) This is substantially similar to the technique in Francois

described in detail above. (Bajaj, ¶¶97-98.)

Manner, Rationale and Motivation to Combine (Rosenberg and Francois).

It would have been obvious to combine the digital mirror system of Rosenberg with Francois's teachings regarding camera-to-user viewpoint image transformations. The combination would have predictably resulted in the digital mirror system of Rosenberg in which video images captured by the camera would have been further processed (in addition to being left-right inverted using Rosenberg's techniques) using Francois's transformation equations. The combination therefore would have resulted in **"applying a transformation mapping to the image to modify the image such that it appears to mimic a reflection of a mirror."**

Rosenberg and Francois are analogous references as both fall within the same field as the '109 patent and describe similar techniques for adapting a flat panel display to display images that mimic the behavior of a conventional mirror. (Bajaj, ¶100 (citing *E.g.*, Rosenberg, ¶¶0006, 0077, Figs. 3 & 5; Francois, 0021, Abstract).) Rosenberg and Francois are also reasonably pertinent to a number of problems faced by inventor in how to implement such a system. (Bajaj, ¶100.)

An ordinarily skilled artisan would have had ample motivation to combine. Both references describe techniques for providing a simulated mirror using a real-time video stream. (Francois, *e.g.*, 0021; Rosenberg, *e.g.*, ¶¶0026, 0077.) A skilled artisan would have naturally turned to an analogous reference such as Francois,

which picks up where Rosenberg leaves off by disclosing specific equations and techniques for translating and scaling images captured by a camera to simulate a conventional mirror image when displayed. (Bajaj, ¶101.)

And Francois provides multiple express motivations to do just that. After discussing his translation and scaling equations, Francois explains:

Note that under our assumptions, the transform relating the user's view to the camera view is reduced to a scaling and a translation. This model provides a straightforward and efficient way of synthesizing the viewer's image stream from the camera stream, while remaining a reasonable approximation for a large class of applications. The major field-of-view variations occurring [sic] when varying the angle of view and the distance to the mirror, are convincingly simulated.

(Francois, 0023.) The above passage provides multiple express motivations to combine, explaining that the transformation in Francois provides “a straightforward and efficient technique,” applicable to “a large class of applications,” and is capable of “convincingly simulat[ing]” the field of view (FOV) variations that one would see when viewing a conventional mirror. (*Id.*) An ordinarily skilled artisan would thus have been motivated to adapt the transformation techniques in Francois to achieve these benefits. (Bajaj, ¶102.) The proposed combination would thus have benefitted from images that are both (a) flipped along vertical axis as disclosed in Rosenberg (one aspect of a convincing mirror simulation), as well as (b) transformed

using the more sophisticated mirror transforms in Francois described above, resulting in a mirror simulation better than one that would have been provided by Rosenberg alone. (*Id.*)

An ordinarily skilled artisan would also have found it natural to apply both the Francois transformations and the vertical axis flipping as disclosed in Rosenberg, to a camera-captured image. (Bajaj, ¶102, fn.4.) Francois itself discloses a step that involves flipping (or mirroring) an image after transformation but prior to display. (*Id.* (citing Francois, Fig. 6, 0023 (disclosing step of “**Mirror image (from user’s viewpoint)**” after “**Mirror transform**” and before “**Mirror display**”).) And Rosenberg, as noted, confirms that other transformations can be applied in addition to vertical axis flipping, such as “scaling” the image to create a “life-size mirror image.” (Rosenberg, ¶0077; Bajaj, ¶88.) Both Francois and Rosenberg thus reinforce that image transformations (such as the scaling explicitly provided by the Francois equations) could readily have been combined with, and operated alongside, the vertical flipping in Rosenberg. (Bajaj, ¶102 fn.4.) A skilled artisan would thus have perceived no technological incompatibility in applying, to an image obtained from a camera, both the Francois transformations described above and vertical axis flipping as disclosed in Rosenberg. (*Id.*)

Petitioner notes that some embodiments in Rosenberg depict a wall-mounted display whereas Francois describes a smaller/handheld display, but this represents

at best a routine implementation decision presenting no obstacle to the proposed combination. The transformations in Francois do not depend on the form factor or size of the display, and Francois itself discloses an embodiment involving a larger display. (Bajaj, ¶103 (citing Francois, 0023).) Moreover, Rosenberg refers to and incorporates-by-reference a patent on a handheld gaming device enabling “self-portrait” capability, further underscoring its applicability to smaller devices. (*Id.* (citing Rosenberg, ¶0005 and Ex. 1027).) A skilled artisan would have also had at least a reasonable expectation of success as the proposed combination would have required nothing more than conventional techniques. (Bajaj, ¶¶104, 92, 96.)

(d) “resizing the image to reduce variations caused by changes in object’s distance to the camera;” (Claim 1[d])

Limitation 1[d] recites “**resizing the image**” separately from the step of “**applying a transformation mapping to the image**” in limitation 1[c], but the ’109 patent contemplates that the claimed resizing (*e.g.* scaling) can occur as part of the overall transformation mapping process. (*See, e.g.*, ’109, 29:38-40, 17:18-27.) This is expressly confirmed by dependent claim 6 addressed below, which depends from claim 1 and recites that “**the step of resizing the image is performed integral to the step of applying the transformation mapping**.” Francois discloses this.

As explained for limitation 1[c], Francois describes a transformation that modifies the image to mimic a reflection of a mirror. As further explained below, the transformation in Francois also results in “**resizing the image to reduce**

variations caused by changes in object’s distance to the camera,” with “object” corresponding (for example) to the person/viewer looking at the mirror/display. As explained below, the transformations in Francois result in an image being scaled up (resized) when the distance d of the user to the display increases. (Bajaj, ¶106.)

By way of background, anyone who has looked at themselves in a mirror while walking closer to the mirror may have noticed that the person remains approximately the same size regardless of the distance to the mirror. (Bajaj, ¶107.) The reason is straightforward and well-understood – when viewing an object in the real world (*i.e.* not in a mirror), differences in distance cause the object to appear smaller (with increased distance) or larger (with decreased distance). But when looking at a reflective mirror, these viewable differences in size are significantly reduced by the fact that the angle of the person’s field of view (FOV) changes as their distance to the mirror changes. (*Id.*) This phenomenon is a well-known characteristic of conventional mirrors and expressly acknowledged in the Background of the ’109 patent. (’109, 2:19-23; Bajaj, ¶¶107-108.)

Accordingly, the purpose of the claimed step of “**resizing the image to reduce variations caused by changes in object’s distance to the camera,”** is to modify the image to simulate the consistent-size viewing phenomenon provided by traditional mirrors. (Bajaj, ¶¶109-110.) For example, the patent explains that “[a]n adaptive FOV is required in order to compensate for the changes in the distances

between the user and the screen, so that the user will see his image at the same size, just like in a mirror.” (’109, 14:29-33.) One way to accomplish adaptive FOV, according to the ’109 patent, is to use “digital zoom” to alter the size of the image captured by a camera. (’109, 14:33-39; Bajaj, ¶110.) The specification of the ’109 patent thus confirms that, at a minimum, limitation 1[d] covers at least digitally zooming (*e.g.* enlarging or scaling up) captured images based on distance to mimic the changing FOV associated with images from a conventional mirror. In simpler terms, zooming compensates for the fact that an object in a digital image becomes smaller as its distance increases. (Bajaj, ¶110.)

Francois discloses an image transformation, in which “the transform relating the user’s view to the camera view is reduced to a **scaling** and a translation.” (Francois, 0023, User view synthesis.) The “scaling” in Francois discloses and renders obvious the claimed “**resizing**.”

As described for limitation 1[c], Francois discloses the following transformation equations for mapping the user’s view to the camera image:

$$x_p = d((f + d)x'_p / f + t_x) / ((f + d) + t_z)$$
$$y_p = d((f + d)y'_p / f + t_y) / ((f + d) + t_z)$$

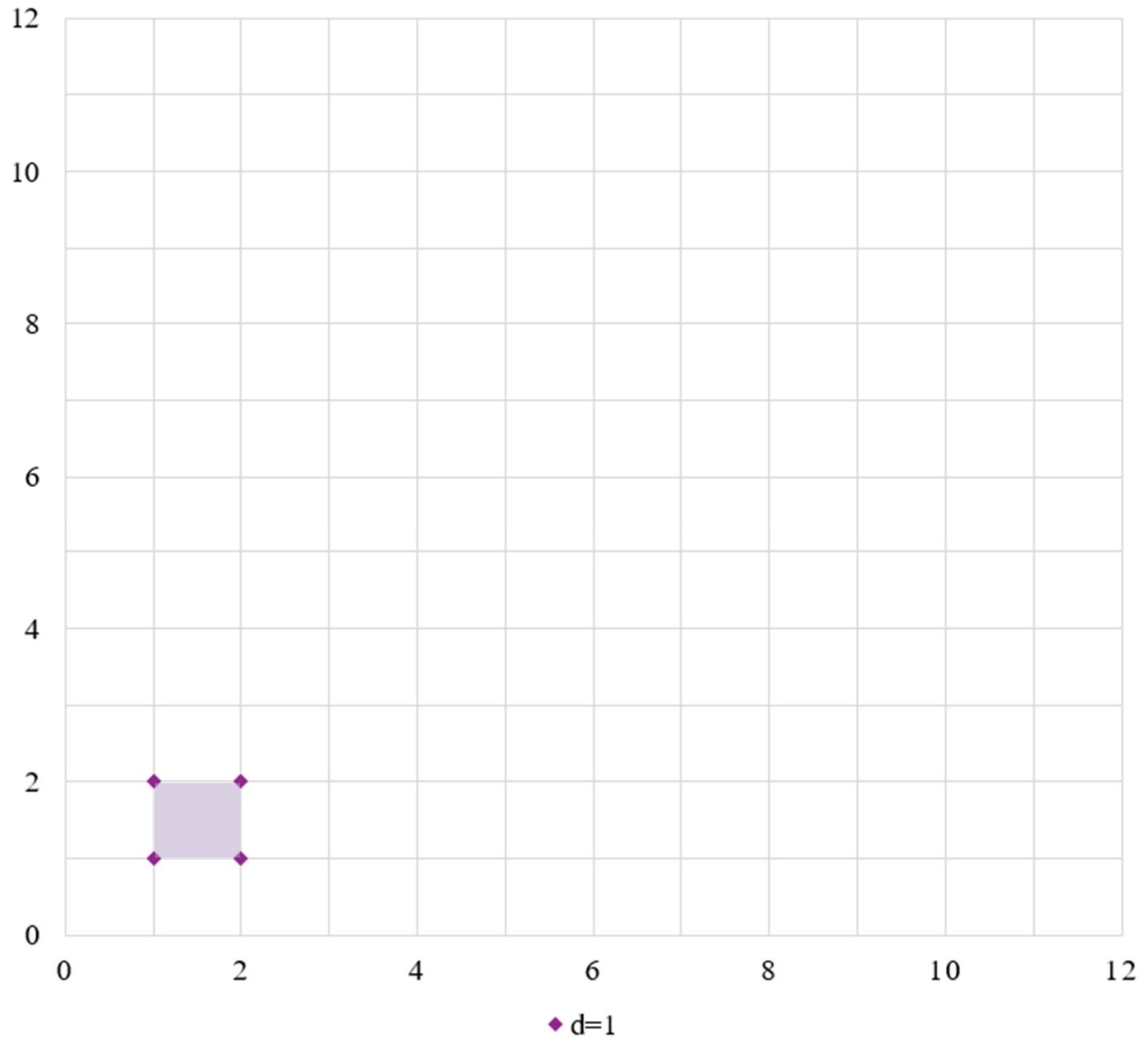
(Francois, 0023.) Both of these equations use the user’s distance d to the mirror/display as a multiplicative factor for both the x and y values, thus causing the output values to increase as the user’s distance d increases. In other words, as the

user moves away from the camera/display, the value of d increases, thus increasing the calculated x and y coordinates and scaling up the image. (Bajaj, ¶111.)

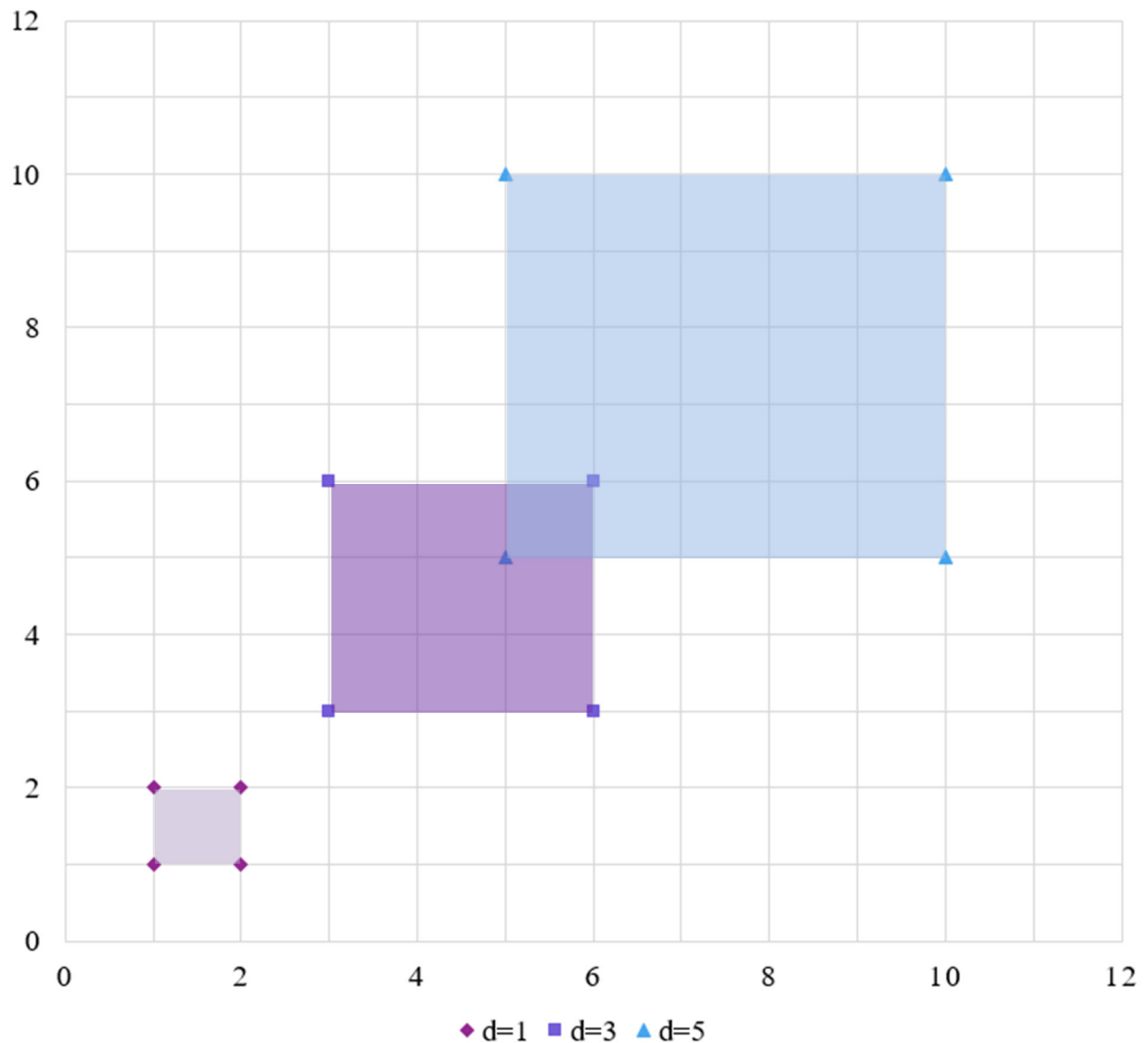
Petitioner's expert provided a simplified example to illustrate how these transformation equations result in “**resizing the image to reduce variations caused by changes in object's distance to the camera,**” for example on increasing the distance d . (Bajaj, ¶¶112-113.) For purposes of this example and focusing on limitation 1[d], let's assume translation parameters (*i.e.*, t_x , t_y , t_z) of zero, thus removing alignment of the camera image and mirror plane from the equations. And for simplicity, let's assume a focal length (*i.e.* f) of one. This simplifies and reduces the two above-mentioned equations to:

$$x_p = d(x'_p)$$
$$y_p = d(y'_p)$$

(Bajaj, ¶112.) Now let's assume, for simplicity of illustration, an original image captured by a camera with four points forming a square, with (x, y) coordinates of $(1,1)$, $(1,2)$, $(2,1)$, and $(2,2)$ and the object at a distance of 1 (*i.e.* $d=1$):



Now let's see what happens when we “plug in” these (x, y) coordinates into Francois's equations and vary the distance (d), for example, by increasing it to three ($d=3$) and to five ($d=5$). The outcome is easy to see – the equations in Francois “scale up” of the image, with the points being remapped in a way that increases the size of the square. Under this simplified example, at distance $d=3$ the square is scaled up three times, and at distance $d=5$ the square is scaled up five times:



(Bajaj, ¶112.) This highly simplified example illustrates how the equations in Francois resize an image, in this case enlarging an object in the image as distance d increases. Of course, in a real-world scenario, the value of distance d may not be a simple integer and may have a more complex relationship with the coordinates used to describe the image, and the translation parameters for aligning the camera image and mirror plane (*i.e.*, t_x , t_y , t_z) would likely not be zero. But regardless of how distance d relates numerically to the coordinates of the image, or the values of the

translation parameters, increasing distance d will enlarge the image because distance d is a multiplier in the Francois equations as discussed above. (*Id.*)

Francois discloses that, using his equations – including the distance-based scaling as described above – “[t]he major field-of-view variations occurring [sic] when varying the angle of view and **the distance to the mirror, are convincingly simulated.**” (Francois, 0023.) This convincing simulation is accomplished, in part, by the resizing/scaling of the image based on variations in distance d , using the equations in Francois. Accordingly, when viewing the resized image on the (fixed size) display screen, the image will more closely simulate the effect of a mirror. (Bajaj, ¶113; Francois, 0023.)

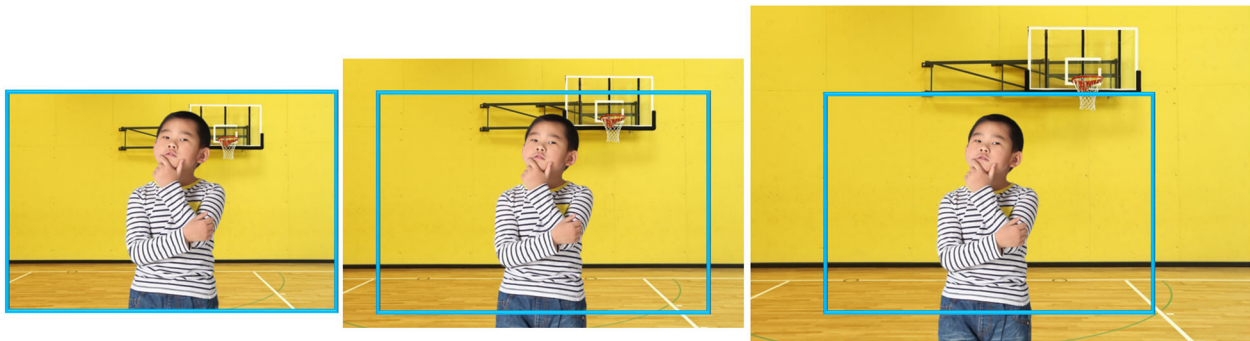
Petitioner’s expert provided a further illustration, using more realistic images, to conceptually show how the transformation equations in Francois would have resulted in an image being resized, in this case scaled up based on increasing distance. We start with exemplary images of a boy shown at different distances:



(Bajaj, ¶115.) The boy is closest to the camera in the left-most image and farthest away in the right-most image. Because these are images provided by a camera – not

a mirror reflection – the boy’s size in the image noticeably decreases as his distance to the camera increases. (*Id.*)

To convincingly simulate a mirror view, as explained, the boy should remain approximately the same size regardless of his distance to the camera. This can be accomplished by scaling the image using a zooming technique as disclosed in Francois. For example, let’s zoom or enlarge the middle and right-side images to accommodate the increasing the distance of the boy to the camera:



(Bajaj, ¶115.) The blue box represents a fixed size associated with a computer display on which the images will be shown. As illustrated, as the boy’s distance to the camera increases, the image captured by the camera is enlarged – which is what would occur when applying Francois’s transformation equations. (*Id.*) As a result, when the enlarged images are displayed – cropped to the display size shown in the blue box – the boy appears approximately the same size in all the three images:



(Bajaj, ¶115.) This illustrates how, using a scaling-up technique based on distance as disclosed in Francois, the consistent-size behavior of a conventional mirror is simulated for the middle and right-side images as distance increases. (*Id.*)

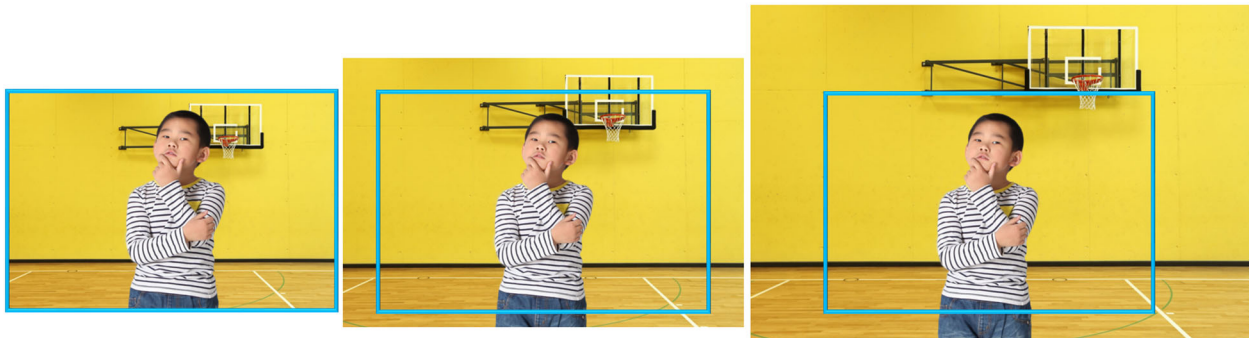
An ordinarily skilled artisan would have therefore understood that Francois teaches “**resizing**” an image satisfying limitation 1[d], for example, because increasing distance d , which will enlarge the image, results in an approximately consistent size of an object regardless of its distance to the camera. (Bajaj, ¶115.) It therefore would have been obvious, based on the proposed combination of Rosenberg and Francois, to “**resiz[e] the image to reduce variations caused by changes in object’s distance to the camera.**” The rationale and motivation to combine Rosenberg and Francois explained in connection with claim 1[c] applies here as well. (Bajaj, ¶¶99-104.) Francois itself provides a clear motivation to implement his resizing techniques by stating that his transformations – which include scaling of the image based on distance – result in “convincingly simulat[ing]” a mirror reflection. (Francois, 0023.)

“Cropping” A Zoomed Image to the Display Size

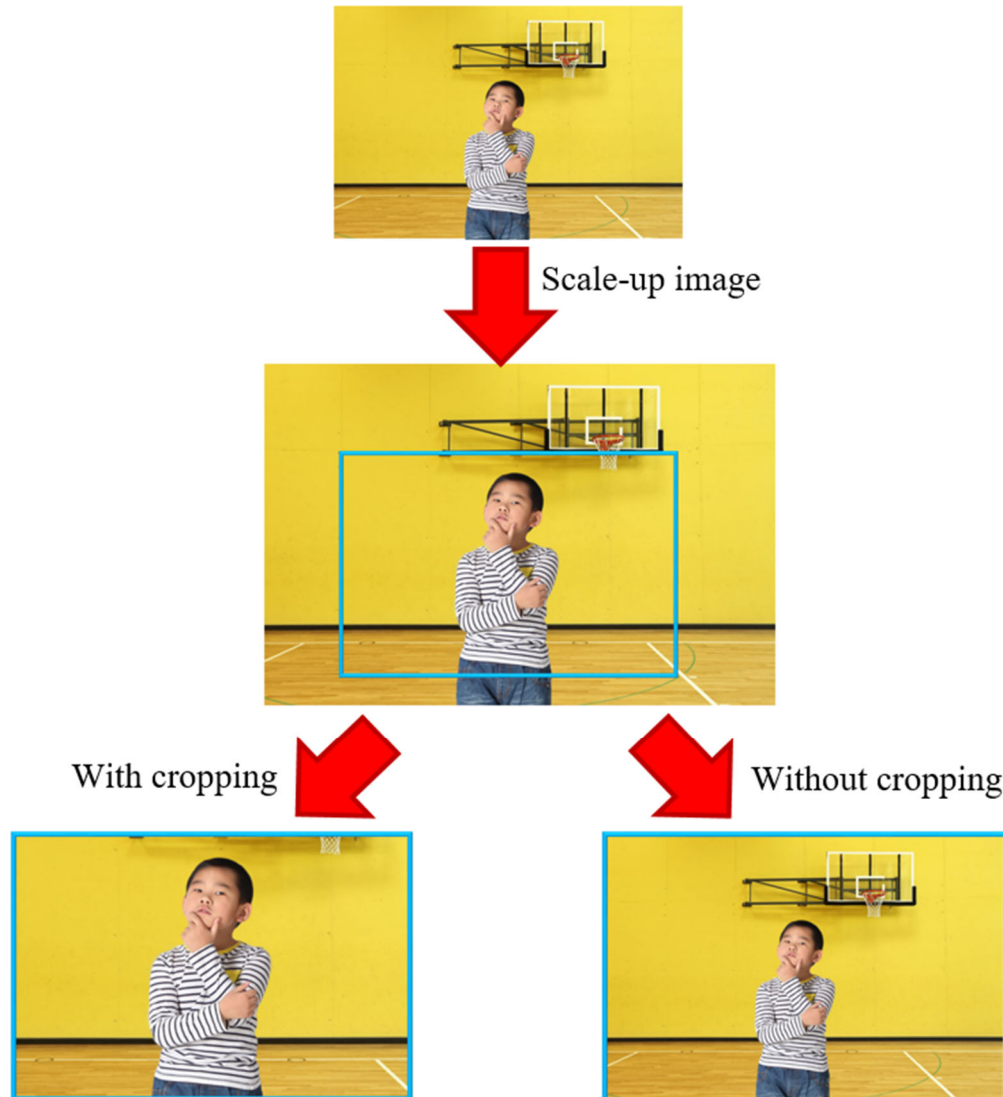
In the examples above, when an enlarged or scaled-up image is displayed, it is cropped so as to fit the size of the computer display device or monitor. Cropping refers to a well-known image processing step of removing unnecessary or unused areas from an image, as in the examples above, by trimming the edges or sides of an

image to eliminate those portions that will not be presented on the display. (Bajaj, ¶¶60, 116.) Cropping was (and remains to this day) a widely known technique such that anyone had ever used a photo editing tool by December 2012 (such as a mobile phone's photo app) would likely have been familiar with it. (*Id.*)

Francois does not expressly state that it crops images that are transformed and scaled-up, but it would have been obvious to apply cropping to such images. (Bajaj, ¶117.) In fact, in order to simulate a mirror-like presentation in which an object is approximately the same size regardless of the distance, it would have been necessary to crop the image after it enlarged or scaled-up based on increased distance d , as shown again in the middle and right examples from above:



(*Id.*) With respect to the middle and right-side images – which are scaled up versions of the original image on the left – if they were not cropped to fit the display as shown in blue rectangles in this example, the boy would not look larger in the scaled-up image. This is because more of the display area would be devoted to the surrounding image, thus resulting in the boy being correspondingly smaller:



(Bajaj, ¶118.) As demonstrated by this simplified example, the boy in the scaled-up image without cropping does not look significantly larger than the original image – defeating the purpose of scaling up to simulate mirror appearance. It thus would have been obvious to any skilled artisan that the resized images in Francois, when scaled-up based on increased distance, would have been cropped to achieve Francois’ objective in which “[t]he major field-of-view variations occurring when varying... **the distance** to the mirror, are convincingly simulated.” (Francois, 0023;

Bajaj, ¶119.) An ordinarily skilled artisan would therefore have found it obvious, based on Francois alone, to crop a scaled-up image. (Bajaj, ¶¶117-119.)

Cropping would also have been obvious based Francois in combination with **Vidunas** (Ex. 1005), which expressly discloses image cropping. (Bajaj, ¶¶120-129.) Vidunas explains that “[m]any modern video cameras can capture video at resolutions greater than that which can be displayed by many modern display systems, such as computer monitors.” (Vidunas, 1:26-28.) Because higher resolution images consume more data, they require more processing power to display and more bandwidth to transport over a network. (Vidunas, 1:32-37.)

Vidunas addresses this problem by disclosing a number of techniques for “reduc[ing] the resolution of video before transference to a display system.” (Vidunas, 1:39-41; *see also id.*, 1:45-49.) One exemplary technique in Vidunas involves cropping an image, as shown in Figure 6:

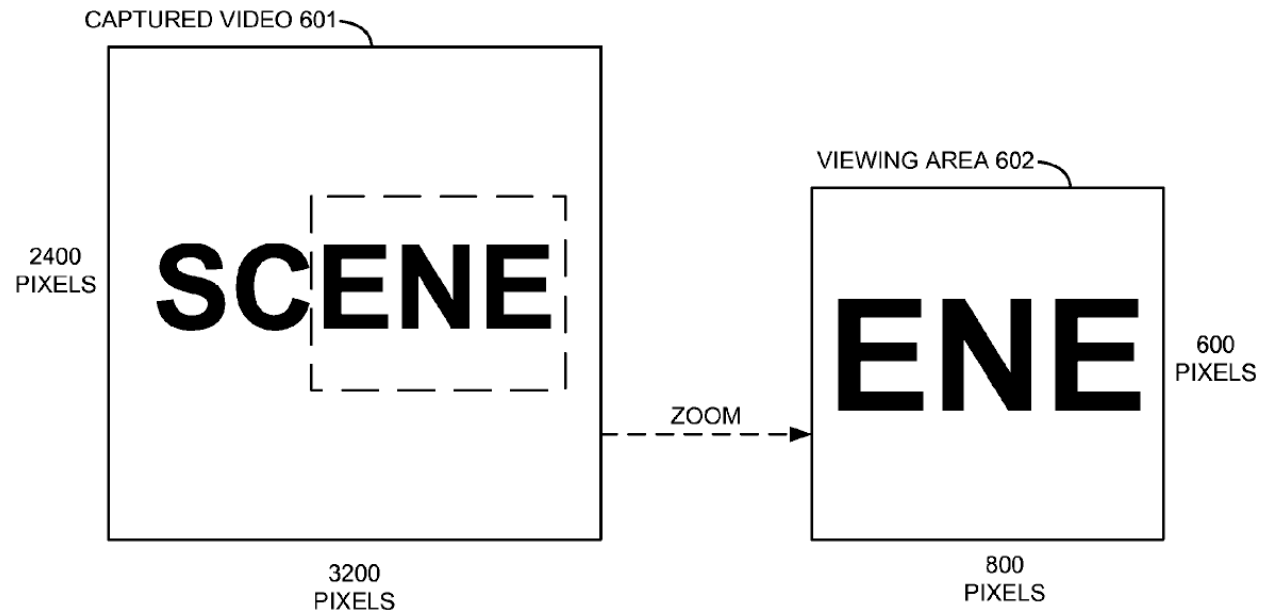


FIGURE 6

(Vidunas, Fig. 6.) Figure 6 shows cropping of an image from a video **601** having a resolution of 3200x2400 pixels to fit smaller viewing area **602**, in this example a display with a resolution of 800x600 pixels. (Vidunas, 7:41-49.)

Figure 6 above shows a process that Vidunas refers to as “digital zooming,” which “crops a section of pixels out of out of the images of captured video **601**.” (Vidunas, 7:66-8:1.) “For example, digital zooming crops the pixels within the dashed rectangle out of captured video **601**. Thus, the amount of pixels within the dashed rectangle stays the same while all the pixels outside the dashed rectangle are removed for the modified video.” (Vidunas, 8:1-6.) Cropping can be performed based on user selection, or automatically based on objects in the image such as when detecting human faces. (Vidunas, 8:23-27; Bajaj, ¶123.)

Manner, Rationale and Motivation to Combine (Rosenberg and Francois with Vidunas): It would have been obvious to combine Rosenberg and Francois with Vidunas. The combination would have predictably resulted in the digital mirror system based on Rosenberg and Francois, in which images that are scaled-up or enlarged using the Francois transformation equations would have been “cropped” to fit the size of the display device. (Bajaj, ¶124.)

Vidunas is an analogous reference falling within the fields of processing and display of video. Vidunas’ disclosures of zooming and cropping techniques would also have been reasonably pertinent to a problem faced by the inventor of how to modify and display a digital image to better mimic the size/appearance of a mirror reflection. (Bajaj, ¶125.) Indeed, one embodiment in ’109 patent discloses “filters to improve image quality,” which may “perform cropping or image resizing as needed for optimization of the image.” (’109, 18:33-36; *see also id.*, 21:1-3.)

An ordinarily skilled artisan would have had ample motivation to combine. With respect to Francois, as noted, it would have been obvious that to achieve a mirror-like appearance of an image scaled up based on increased distance, it would have been necessary to crop the image to the display size. (Bajaj, ¶¶118-119, 126.) This is further enhanced by the disclosure in Vidunas, which confirms that the cropping can be used to emphasize an area of the images where human faces are detected. (Vidunas, 8:21-27.) It thus would have been obvious to crop the images

of the mirror display system described in the Rosenberg-Francois combination to emphasize the user appearing in the image. (Bajaj, ¶126.)

An ordinarily skilled artisan would have also appreciated clear benefits of cropping an image, for example, an image enlarged based on increased distance. Vidunas repeatedly emphasizes that images that consume more data require more processing power to display and more bandwidth to transport over a network. (Vidunas, *e.g.*, 1:32-37, 3:14-17, 11:6-11; Bajaj, ¶127.) Vidunas explains that “[s]caling the images before compression will dramatically reduce the bandwidth required to transmit the compressed images, and it will reduce the CPU power required to decompress the images on the workstation.” (Vidunas, 11:42-46.) Reducing the size of video images by “cropping” unneeded portions (*i.e.* portions that would not be visible on the display) reduces the burden on computing resources by decreasing the amount of data the images consume. (Bajaj, ¶¶127-128.) This would have been particularly beneficial to a mirror-display system such as the one disclosed in Rosenberg in which video images can be stored and/or transmitted over a network. (Bajaj, ¶128 (citing Rosenberg, *e.g.*, ¶¶0108-0109).) A skilled artisan would have had at least a reasonable expectation of success, as image cropping was a well-known and simple technique. (Bajaj, ¶¶129, 116.)

(e) **“displaying the image on the monitor after performing the flipping, transformation mapping, and resizing;”
(Claim 1[e])**

This step merely recites display of the image after performance of steps 1[b]-1[d]. Both Rosenberg and Francois disclose displaying captured video images after performing processing on them, and Vidunas discloses display after the images are cropped to fit the viewing area of the display. (*E.g.*, Rosenberg, ¶0077 (“the real-time video image is left-right inverted prior to display upon the screen”), claim 19 (“inverting the real-time video image prior to displaying the inverted real-time video image upon the display screen”); Francois, 0023, Fig. 6 (“Mirror transform” and “+ Mirror image (from user’s viewpoint)” steps before “Mirror display” step), Vidunas, 8:8:9-17) Under the proposed combination, “**the image**” displayed would have been subjected to the flipping, transformation mapping, resizing (including cropping), as discussed above. (Bajaj, ¶130.) It also would have been obvious that the image would have been displayed “**on the monitor,**” *i.e.*, a display screen. (*Id.* (citing Rosenberg, ¶0077 & Fig. 5 (wall-mounted screen); Francois, 0023 (“...display...on the LCD screen.”), Vidunas, 10:29-33 (display system **1002**).)

(f) **“wherein the non-ordered steps are performed on a series of images of a live video feed from the camera;”
(Claim 1[f])**

As noted, Rosenberg and Francois disclose techniques to mimic a mirror by processing images in real-time from a camera’s live video stream. (*E.g.*, Rosenberg,

¶¶0006 (“real-time captured images”), 0026 (“real-time streamed video images”), 0077; Francois, 0021, “Abstract” (“The continuous input video stream and tracker data is used to synthesize, in real-time, a continuous video stream displayed on the LCD screen.”), 0023, System Integration (“Real-time camera and tracker inputs are used to synthesize the mirror image stream and display it in real-time on the LCD screen”); *see also* Vidunas, 4:36-49 (“Video source **101** may be a video camera, a computer web cam, a digital camera, or some other device capable of capturing video images – including combinations thereof.”).) It would have been apparent and obvious that the real-time video in Rosenberg and Francois provides “**a series of images of a live video feed,**” as claimed, because real-time video provides a series of live/current images captured by the video camera. (Bajaj, ¶132.) The combination of Rosenberg and Francois thus would have predictably resulted in the recited steps being performed on that series of images. The rationale and motivation to combine Rosenberg and Francois provided for claim 1 [c] applies here. (*Id.*)

Petitioner notes that steps 1[a], [b], [c] and 1[e] are performed by the combination of Rosenberg, Francois and Vidunas for each of the series of images of a live video feed. But depending on the nature of the video data, the resizing step recited in step 1[d] might not necessarily occur for every single video image received by the system. It is thus theoretically possible – although highly unlikely – that the distance of the person to the camera might be such that the claimed “resizing” is

unnecessary (for example, when the person's distance to the camera is equal to the camera's focal length). (Bajaj, ¶133.) But the remote possibility that one of steps 1[a]-1[e] might not be performed in particular scenarios provides no basis to distinguish the claims from the art. *See, e.g., Hewlett-Packard Co. v. Mustek Sys., Inc.*, 340 F.3d 1314, 1326 (Fed. Cir. 2003) (“[A] prior art product that sometimes, but not always, embodies a claimed method nonetheless teaches that aspect of the invention.”). It would have been obvious that, when implementing the proposed combination of Rosenberg, Francois and Vidunas, to apply it to a series of images in which the distance to the camera would have necessitated some degree of resizing, thus resulting in performance of step 1[d]. (Bajaj, ¶133.) In any case, it would have been obvious to perform every one of steps 1[a]–1[e] on a series of images of a live video feed from the camera, under the proposed combination. (*Id.*)

“Non-Ordered Steps”

As noted in the discussion of the preamble, claim 1 begins by reciting “performing **non-ordered** steps comprising,” and limitation 1[f] recites that “**the non-ordered steps are performed.**” Petitioner has argued in the pending litigation that “**non-ordered steps**” creates a lack of reasonable clarity as to the full scope of the claim. This is because the actual steps recited in claim 1 impose requirements on the order in which at least some of them are performed.

The claim makes clear, for example, that limitation 1[a], “obtaining a digital image from a camera,” must occur before limitations 1[b]-[d], which recite that the obtained image is flipped, transformation mapped, and resized. And steps 1[b]-1[d] must occur before limitation 1[e], which expressly recites “displaying the image on the monitor after performing the flipping, transformation mapping, resizing [steps].” Petitioner has therefore argued in the litigation that the description of the steps of claim 1 as “**non-ordered steps**” is inconsistent with the fact that at least some steps, by their very terms, must occur in an order.

Petitioner recognizes that the parties’ indefiniteness dispute is not cognizable in IPR, but that dispute presents no obstacle to applying the prior art described here. This is because the proposed combination performs step 1[a] before steps 1[b]-1[d], which in turn occur before step 1[e] – thus satisfying the narrower view in which the claim imposes such an order on these steps. The recitation of “**non-ordered steps**” thus does not impact the prior art analysis here because the term suggests, at most, an intent to broaden the claim to permit – but not require – that steps be performed without regard to order. In other words, the ambiguity created by “non-ordered steps” does not prevent the Board from applying the more restrictive and narrower (ordered) view disclosed by the proposed grounds.

(g) “**determining distance to a user appearing in the live video feed; and,**” (Claim 1[g])

The equations in Francois, as explained previously, take into account the

distance of the user to the camera, expressed as distance d . (Francois, 0023, User view synthesis.) To obtain this value, Francois discloses a head tracker that determines the user's distance to the display/camera. (Francois, 0021, Fig. 1, Introduction (“trackers giving in real time the positions and orientations of the camera and the user's head”), 0023, User view synthesis (“The positions and orientations of the user's viewpoint and the camera center provided by the tracking devices, allow to compute both the distance d and the change of referential translation parameters.”).) Francois therefore discloses “**determining distance to a user appearing in the live video feed.**”

Limitation 1[g] merely requires determining distance to a user, without specifying any particular technique for making the claimed distance determination. In any case, it would have been obvious that, under the proposed combination of Rosenberg and Francois, to determine the distance to a user who appears in the live video feed captured by the camera. An ordinarily skilled artisan would have been motivated to provide a means of determining distance of a user (such as the head tracker in Francois) in order to perform the scaling transformations of Francois – which expressly rely on the distance parameter d , thus necessitating some mechanism by which the distance to a user is determined. (Bajaj, ¶137.) Those transformations, as described above, are specifically designed to provide a more convincing mirror display. (Francois, 0023, right column; Bajaj, ¶137.)

Petitioner notes that Rosenberg similarly discloses that its system includes “one or more proximity and/or motion sensors” for “detecting whether a person (or a similar object) is located before and/or moves before the display screen” (Rosenberg, ¶0069; *see also, e.g., id.*, ¶¶0032, 0056), further confirming that Francois’s teachings regarding use of a head tracker for distance determinations are combinable and compatible with Rosenberg. (Bajaj, ¶137.)

(h) “varying rate at which the non-ordered steps are performed on the series of images according to the distance.” (Claim 1[h])

Rosenberg, Francois and Vidunas do not expressly describe varying the rate at which the “non-ordered steps” (described above) are performed. But this would have been obvious in further view of Dunton [Ex. 1006] and Yong [Ex. 1007], which disclose techniques for varying the “frame rate” associated with processing video captured by a video camera. The term “frame rate” generally refers to the frequency (or rate) at which sequential images (or “frames”) of a video are captured, processed, and/or displayed. Frame rate is commonly expressed as a number of frames-per-second (FPS). (Bajaj, ¶¶67, 138.) Frame rate is often used to measure the rate at which a digital video system performs the overall process of capturing digital images and performing the necessary processing on those images to enable them to be displayed. (*Id.*, ¶67.)

Dunton and Yong both disclose the ability to increase the frame rate by

cropping or otherwise reducing the frames so they consume less data. The “Background” section of Dunton, for example, explains:

To meet a given image frame rate over a limited transmission bandwidth, one solution is to simply electronically scale the detailed still image frames into lower resolution image frames prior to transmitting them. Alternatively, the detailed image can be “cropped” to a smaller size, and therefore lower resolution image. In this way, the amount of spatial data per image frame is reduced, so that a greater frame rate can be achieved between the digital camera and the host computer.

(Dunton, 1:35-43.) Dunton discloses one example in which, when cropping an image to focus on nearer objects, the image consumes less space and thus enabling an increased frame rate. (Dunton, 4:61-5:15; Bajaj, ¶139.)

Yong similarly discloses increasing the frame rate of a video by reducing the size and/or resolution of frames of the video:

A new method, apparatus and software product are presented for implementing algorithms for improving (i.e., increasing) a frame rate by reducing a size and resolution (i.e., size/resolution) of selected (or chosen) versus unselected image frames captured by a sensor in an image processing pipeline before displaying (or before encoding stage) in electronic devices (e.g., cameras, wireless camera phones, etc.), according to various embodiments of the present invention.

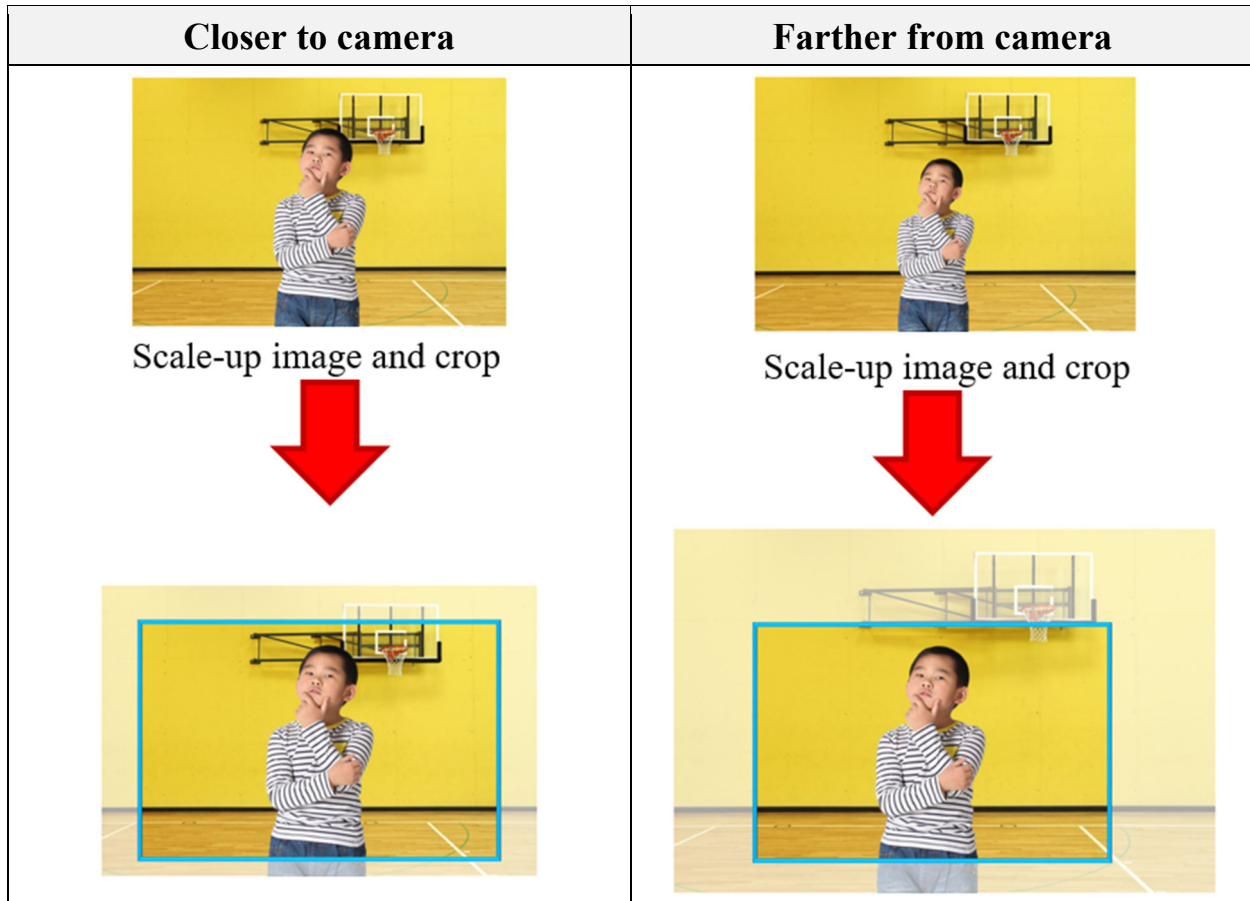
(Yong, 4:25-32.) This results in an increase in frame rate because, as Yong explains, reducing the image in size or resolution reduces the amount of processing time required for the reduced frames of the video. (Yong, *e.g.*, 6:6-15.)

Dunton and Yong disclose a video-specific example of a plainly obvious universal truism – that a computer system can process data more quickly when there is less of it to process. (Bajaj, ¶141.) As applied to video, Dunton and Yong disclose varying the frame rate for video image processing based on the amount of data the images consume – *e.g.*, increasing the frame rate for a video when the images of the video are modified such that they consume less data. (*Id.*)

Manner, Rationale and Motivation to Combine (Rosenberg, Francois and Vidunas with Dunton and Yong): It would have been obvious to combine the mirror-display system disclosed by the combination of Rosenberg, Francois, and Vidunas with Dunton and Yong. The combination would have predictably resulted in the method by the proposed combination of Rosenberg, Francois, and Vidunas in which the frame rate for the video is varied (*e.g.* increased) as a result of the transformations in Francois and Vidunas that reduce the amount of data that the images consume. (Bajaj, ¶¶142-144.)

As explained in detail for limitation 1[d], Francois discloses mirror transformation equations that, among other things, scale images based on the distance d of the viewer to the mirror/display. These equations, for example, would

result in an image being *scaled up* or enlarged when the viewer is further away from the display. For example, as shown in the images below, as the boy moves farther from the camera, more of the image is cropped for the display:



(Bajaj, ¶143.) As further explained for limitation 1[d], images that were scaled-up using the Francois equations would have been cropped to fit the size of the display monitor, which would in turn have reduced the amount of data for the images. This is because, as illustrated by the example above, the amount of data that cropped and thus removed from the image (the area outside the **blue** rectangles) increases when the user is further away from the camera because, as noted, the amount of scaling

increases with distance under the Francois equations. Accordingly, as the person moves further away from the camera, the amount of scaling and cropping increases, thus reducing the amount of data the resulting image will consume. (*Id.*)

It thus would have been obvious, based on the further combination with Dunton and Yong, to *increase* the frame rate for the mirror display system of the proposed combination of Rosenberg, Francois, and Vidunas, when processing images that were scaled-up to account for increased distance. (Bajaj, ¶144.) Under the proposed combination, therefore, this increase in frame rate would have increased the number of frames-per-second of digital video that the system could process – thus increasing the rate at which the proposed combination performs the steps of capturing a digital image from a camera (1[a]), flipping the image about a vertical axis (1[b]), applying a transformation mapping to and resizing the image (1[c]-[d]), and displaying the image (1[e]), based on the teachings of Rosenberg, Francois and Vidunas – thus **“varying rate at which the non-ordered steps are performed on the series of images.”** Because steps 1[a] through 1[e] are performed under the proposed combination with respect to each frame of captured video (on a frame-by-frame basis), adjusting the frame rate as disclosed in Dunton and Yong would have resulted in varying the rate at which these steps are performed.

This varying also occurs **“according to the distance,”** as claimed, because the measured distance d is used in the Francois equations in order to scale up an

image based on increasing distance. Under the proposed combination, in other words, the rate at which the mirror system under the combination of Rosenberg, Francois and Vidunas performs steps 1[a] through 1[e] will increase when the distance d of the user to the mirror/display increases. (Bajaj, ¶144.)

To be clear, although Dunton and Yong disclose specific techniques for reducing the size of a video frame, the proposed combination does not rely on those techniques. As explained at length for limitations 1[b]-1[d], the proposed combination relies on Rosenberg, Francois, and Vidunas to produce a frame that, when scaled up and cropped when the distance increases, will consume less data. The proposed combination relies on Dunton and Yong for their more general teachings of increasing video frame rate in response to a reduction in the amount of frame data – teachings that apply regardless of the particular techniques used to reduce the amount of image data. (Bajaj, ¶145.) Dunton and Yong are analogous references in the field of image processing and display of video, and would have been reasonably pertinent to a problem faced by the inventor, for example, of how to improve and/or optimize the appearance and performance of video. (Bajaj, ¶146.)

An ordinarily skilled artisan would have had a clear motivation to combine – to improve the appearance and performance of video. As noted, the scaling and cropping that occurs under the proposed combination, when the distance increases, would have reduced the amount of image data. Dunton provides an express

motivation to increase the frame rate in this situation by explaining that when an image is cropped to a smaller size, “the amount of spatial data per image frame is reduced,” and as such, “a greater frame rate can be achieved between the digital camera and the host computer.” (Dunton, 1:38-43.) It was well-known that increasing the frame rate for a video can provide a direct improvement to the user’s experience by making the motion in the video appear smoother and more natural. (Bajaj, ¶¶68, 147.) By increasing the frame rate, therefore, video quality would have been improved. (*Id.*, ¶¶147, 149.)

Petitioner notes that, under the proposed combination, an increase in frame rate would have occurred when the user moves *further* away from the mirror/display – but not closer. But this would not have discouraged the proposed combination because an ordinarily skilled artisan would have welcomed any improvement in frame rate (and thus video quality), even if that improvement did not manifest in all possible use cases or scenarios. (Bajaj, ¶148.) A skilled artisan would have recognized that, in developing video applications, it is often beneficial to operate at the highest frame rate permitted based on available processing power, storage, network bandwidth, and other computing resources. As such, a skilled artisan would have been motivated to take advantage of the computing resources freed up by reducing the amount of image data, by increasing the frame rate as taught in Dunton and Yong and thereby improving the quality of video. (*Id.*) The technique

in Dunton and Yong thus could have achieved an increased frame rate while imposing few (if any) additional burdens on computing resources. (*Id.*, ¶149.)

Dunton itself provides a further motivation to combine by expressly disclosing a relationship between (1) the video frame rate and (2) the distance of the object to the camera. (Bajaj, ¶150.) Dunton, as noted, expressly describes increasing the frame rate for a video when capturing near image data. (Dunton, 4:61-5:15; Bajaj, ¶¶139, 150.) Petitioner notes that this embodiment in Dunton differs from the proposed combination in that, under the proposed combination, frame rate increases when object distance increases. (Bajaj, ¶150.) But an ordinarily skilled artisan would not have regarded this difference as significant, as it is a mere by-product of the particular implementation in Dunton that processes only a portion of the pixel data captured by the image sensor for near image data. (*Id.*; Dunton, *e.g.*, 4:61-5:9.) A skilled artisan would have had at least a reasonable expectation of success and could have implemented the claimed varying using routine and conventional programming techniques. (Bajaj, ¶¶150-151.)

2. Claim 2: “The method of claim 1, wherein the transformation mapping renders an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally.”

Rosenberg discloses “**a camera positioned at eye-level height and pointing horizontally.**” Rosenberg explains that the camera can be positioned in various

places, such as within the display at approximately eye-level height and pointing straight ahead, as illustrated in Figure 4:

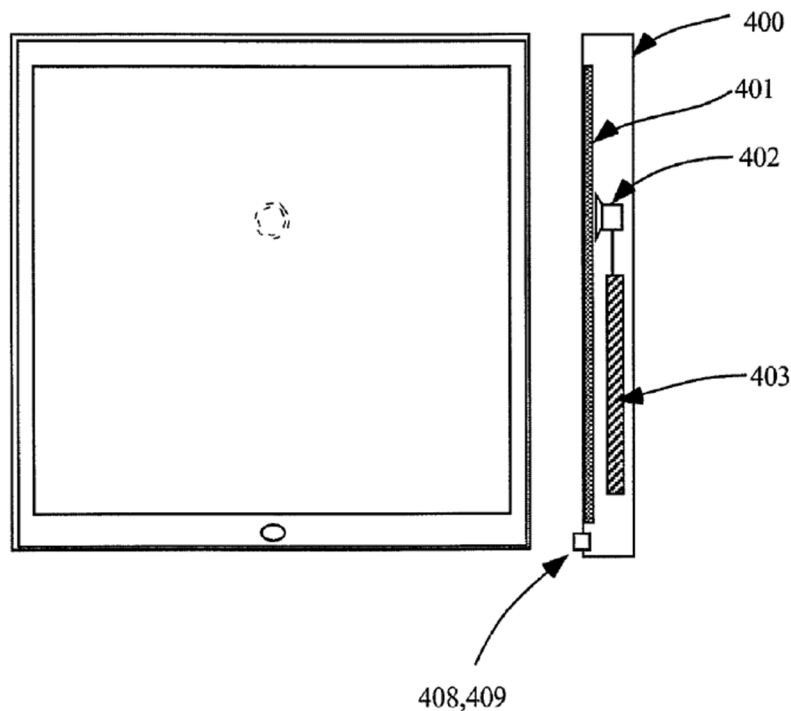


Fig. 4

(Rosenberg, Fig. 4; *see also id.*, ¶0075.) Referring to Figure 4 above, Rosenberg explains that the camera is positioned at approximately eye-level height of a typical user and points horizontally with respect to the display's surface (and also the floor, as a "wall mirror"):

Unlike the embodiment shown in FIG. 3 where the camera is mounted above the display screen, the embodiment shown in FIG. 4 has a camera **402** mounted within the screen area. Such embodiments may be

preferred because they yield more realistic replications of traditional mirrors because the displayed image that is from a vantage that is straight ahead. Such embodiments of the present invention often strive to achieve placement of the camera **402** such that the image captured by the camera **402** is taken from a vantage point that is centered horizontally with respect to the display screen and **at an elevation vertically that generally corresponds with a user's typical eye level**. In this way the user is looking straight at the camera 402 when standing centered before the digital mirror display screen.

(Rosenberg, ¶0075; *see also id.*, ¶¶0027 (“[T]he camera is mounted...approximately at eye-level of typical users....”), 0028 (“...placement of the camera such that the image captured by the camera is taken from a vantage point that is centered horizontally with respect to the display screen and at an elevation vertically that generally corresponds with a user's typical eye level.”), 0060-0061.)

Under the proposed combination of Rosenberg with Francois and Vidunas, it would have been obvious to apply Francois's **transformation mapping** to an image captured by an eye-level camera as disclosed in Rosenberg. In other words, Francois's transformations would have been applied to an image captured by a camera positioned at eye-level height and pointing horizontally. This would have predictably resulted in “**render[ing] an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally.**” (Bajaj, ¶154.) An ordinarily skilled artisan would have been motivated to capture the image

using an eye-level camera, as disclosed in Rosenberg, to provide an image that more closely approximates the user's viewpoint. Such an image would have provided a better "starting point" for Francois' transformation equations as it would have been "closer" to the user's viewpoint (as compared to a camera above the display). This would in turn have resulted in less severe image transformations in Francois, thus increasing the quality of post-transformation images. (*Id.*)

Second, even in an implementation of the proposed combination involving a camera that is **not** physically at eye-level, the transformation mapping under the proposed combination would still **"render[] an image appearing to have been taken from a camera positioned at eye-level height and pointing horizontally,"** as claimed. This is because, using the techniques in Francois, the captured image would have been advantageously translated in the vertical direction to the user's eye-level height, based on the information provided by the head tracking device. (Bajaj, ¶155 (citing Francois, 0023, User view synthesis ("The positions and orientations of the user's viewpoint and the camera center provided by the tracking devices, allow to compute both the distance d and the change of referential translation parameters."))).) It this would have been obvious that feeding the images into Francois's would have resulted in images that appear to have been taken from an eye-level camera pointing horizontally, as part of the process of relating the camera image to the user's viewpoint. (Bajaj, ¶155.)

3. Claim 6: “The method of claim 1, wherein the step of resizing the image is performed integral to the step of applying the transformation mapping.”

As fully explained in the analysis of claims 1[c] and 1[d] above, the image scaling in Francois (“**the step of resizing the image**”) takes place as part of (“**is performed integral to**”) Francois’s transformation equations (“**the step of applying the transformation mapping**”). (Bajaj, ¶¶105, 157.)

4. Claim 8: “The method of claim 1, further comprising applying a translation transformation to move the image within display area of the monitor.”

Claim 8 is disclosed by and obvious over Rosenberg, Francois and Vidunas. With respect to Rosenberg, it describes a “composite image” feature to display multiple images collected by the camera at different points in time. (Rosenberg, ¶0048.) The feature involves moving an image from the center of the display area to the left or right, thereby creating a “multi-view mirroring” experience:

[F]or example, a user can freeze his left profile by turning to the right and uttering “freeze.” The user then can move the frozen image to the left side of the display by uttering “move left”. The image then appears on the left side of the display and the central display resume the standard mirroring function. The user can then freeze his right profile by turning to the left and uttering “freeze”. The user can then move the frozen image to the right side of the display by uttering “move right.” The image then appears on the right side of the display and the central display again resumes the standard mirroring function.

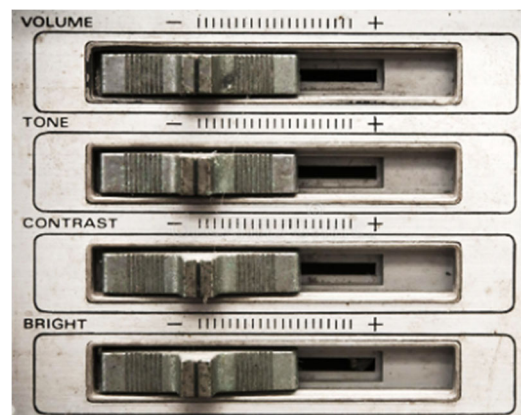
(Rosenberg, ¶0048.) By moving an image to the left or right within the display area as Rosenberg teaches, the system **appl[ies] a translation transformation**—i.e., transforming the image on the display by moving its location (translating it) to the left or right “**within display area of the monitor.**” (Bajaj, ¶159.) An ordinarily skilled artisan would have been motivated to implement this feature in the proposed combination to achieve the benefits of Rosenberg’s frozen images feature, as identified in Rosenberg above. (*Id.*)

And even putting aside the frozen images feature, the mirror transformation in Francois itself comprises a “**translation transformation to move the image within display area of the monitor,**” as claimed, because the transformation equations in Francois map an image captured by a camera to a user’s viewpoint, by using image translation and scaling as discussed in detail for limitations 1[c] and 1[d] above. (Bajaj, ¶160.) The translation process in Francois, in other words, results in “**mov[ing] the image within display area of the monitor,**” because the image will be modified such that objects in the image will be readjusted or relocated when viewed on the screen, as a result of transforming the image to reflect the viewpoint of the user. (*Id.*) The same is true for the resizing and cropping process in Francois and Vidunas – they will also result in “**mov[ing] the image within display area of the monitor,**” because the image will be resized and cropped such that objects will be in different locations on the display. (*Id.*)

5. Claim 9: “The method of claim 1, further comprising changing illumination intensity of individual or groups of pixels of the monitor, so as to enhance shading or illumination in the image.”

Rosenberg discloses a “lighting emulation feature” in which “well known image processing techniques are used upon the real-time video imagery to alter the natural lighting conditions of the imagery to that of a simulated lighting condition.” (Rosenberg, ¶0116.) “For example, image processing routines may be employed to alter the real-time video image such that the displayed lighting conditions simulate one of natural light, florescent light, or incandescent light.” (*Id.*) This feature discloses and renders obvious **“changing illumination intensity of individual or groups of pixels of the monitor, so as to increase shading or illumination in the image,”** because simulating natural, florescent, or incandescent light would have resulted in changing the illumination of the pixels of the digital image that make up the user shown on the display (“groups of pixels of the monitor”), thus enhancing the illumination of the image as claimed. (Bajaj, ¶163.)

It would also have been obvious to simply use built-in *hardware* controls of any conventional computer display. It was well-known that conventional computer displays had built-in controls for altering the contrast and brightness of displayed images. (Bajaj, ¶164 (citing Ex. 1015, 007-008 & Ex. 1016, 005).)



Brightness and contrast adjustments, in turn, enhance an image illumination and shading by changing the illumination intensity of individual or groups of pixels of a display. (Bajaj, ¶164 (citing Ex. 1015, 008; *see also* Ex. 1016, 005 (explaining “contrast” as “[t]he ratio between the luminous intensity of the darkest and lightest areas in a visual image, which governs how well the human eye can discriminate different objects.”))).)

6. **Claim 17: “The method of claim 1, storing the live video feed in a digital storage device and selectively operating the system in one of a mirror mode or display mode, wherein during mirror mode displaying on the monitor transformed images of what the camera sees at that particular moment while during display mode displaying on the monitor a transformed images of what the camera saw in the past and obtained from the digital storage device.”**

Turning first to “**storing the live video feed in a digital storage device,**” Rosenberg explains that its digital mirror system includes memory (such as RAM—a “digital storage device”) for storing “real-time video imagery from the camera.” (Rosenberg, ¶¶0044 (“the image frame buffer maintains in memory the last 10 seconds of live imagery captured”), 0045, 0089 (“When employing the mirror image-buffer feature, the user is given the ability to selectively store certain time duration real-time video imagery from the camera....The memory may be of any form common to art—for example, RAM with DMA access.”).)

Rosenberg next discloses “**selectively operating the system in one of a mirror mode or display mode.**” Rosenberg explains that its digital mirror system

can be selectively operated in various modes, including a “traditional mirror mode” for displaying a live mirror image of the user (“**mirror mode**”) and an “image buffering” mode for replaying previously-captured video (“**display mode**”).

In what Rosenberg calls its “traditional mirror mode,” “real-time images are streamed video images captured by a camera mounted upon the display, the real-time streamed video images being a left-right inverted representation of the video signal captured by the camera.” (Rosenberg, ¶0026.) Under the proposed combination with Francois, the real-time images (“**images of what the camera sees at a particular moment**”) would have been transformed using the translation, scaling and cropping techniques discussed extensively for claim 1. Under the proposed combination, therefore, the mirror mode of Rosenberg would “**display[] on the monitor transformed images of what the camera sees at that particular moment.**”

Turning to the claimed “**display mode**,” Rosenberg discloses a feature in which the user can switch to “image buffering” mode to view previously-captured video by, for example, using a voice command such as “view buffer” or “replay.” (Rosenberg, ¶¶0045-0046.) In “image buffering” mode, “[i]nstead of the real-time imagery, the previously buffered camera frames are displayed, showing for example the previous 10 seconds of imagery captured by the camera and displayed upon the mirror.” (Rosenberg, ¶0045; *see also id.*, ¶0046 (“the imagery displayed upon the

screen is routed from the buffer”).) Under the proposed combination with Francois, the images replayed from storage – just like the real-time images as discussed – would have been transformed using the translation, scaling and cropping techniques discussed in detail for claim 1. As a result, under the proposed combination, the image buffering mode would “**display[] on the monitor transformed images of what the camera saw in the past and obtained from the digital storage device,**” as claimed. Rosenberg also discloses that a user can selectively switch from this image buffering (“**display mode**”) back to real-time mirror mode (“**mirror mode**”) by using a voice command, such as “end replay” or “end.” (Rosenberg, ¶0046.)

The proposed combination discloses a “**mirror mode**” and a “**display mode**” under both parties’ proposed constructions in the pending litigation. (Bajaj, ¶¶170-171.) With respect to “**mirror mode**,” Patent Owner has proposed that it means “*a mode to display the current appearance of a user as if reflected in a mirror,*” whereas Petitioner has proposed “*a mode of operating as a mirror, where a ‘mirror’ is a reflective surface, or as a display that mimics a reflection of a mirror.*” (Ex. 1012, 003.) The differences are immaterial here, as Rosenberg discloses that its “traditional mirror mode” provides a real-time image of a user currently standing in front of the camera. (Rosenberg, ¶0026.) Rosenberg further discloses providing “the visual impression that [the user] is standing before a traditional wall mirror, viewing a traditional mirror image of [the user].” (Rosenberg, ¶0077; Bajaj, ¶¶83,

170.) As explained, that visual impression would have been further enhanced by the translation, scaling and cropping techniques in Francois and Vidunas. The proposed combination thus discloses and renders obvious any reasonable construction of “mirror mode.”

With respect to “**display mode**,” Patent Owner has proposed “*a mode to display a previously captured user appearance*,” whereas Petitioner has proposed “*a mode of operating as a display*.” (Ex. 1012, 004.) In Rosenberg’s “image buffering” mode (“**display mode**”), previously-captured images of a user standing in front of the camera are displayed back to the user. (Rosenberg, ¶¶0045-0046.)

D. Ground 2: Claims 1, 2, 6, 8, 9 and 17 Are Obvious Over Rosenberg in View of Francois and Vidunas, in Further View of Suzuki

Ground 1 relied on Rosenberg, Francois, and Vidunas for all limitations of the challenged claims except limitation 1[h], “**varying rate at which the non-ordered steps are performed on the series of images according to the distance**,” for which Ground 1 also cited to Dunton and Yong. **Ground 2** presents an alternative mapping for limitation 1[h] by citing Suzuki (Ex. 1008) instead of Dunton and Yong, thus providing a different way of varying the rate at which the steps of claim 1 could be performed according to the distance of the user.

Ground 2 thus establishes that the challenged claims are obvious over Rosenberg in view of Francois, Vidunas, and in further view of Suzuki. For all limitations of all challenged claims, except limitation 1[h], the mapping from

Ground 1 for Rosenberg, Francois, and Vidunas applies here. For limitation 1[h], Ground 2 relies on Suzuki for increasing the frame rate for a different purpose than Ground 1 – to increase video quality by increasing the frame rate when objects being recorded are closer.

Suzuki discloses an imaging apparatus (such as a video camera) that includes a “zoom” function, and which can increase the frame rate for recorded video in response to use of the zoom function. (Suzuki, Abstract (“During a zoom operation period or a period including the zoom operation period and periods before and after the zoom operation, a video signal from the imaging unit is recorded in a recording medium at a high recording frame rate.”).) A “zoom operation” in Suzuki includes either a zoom-in or zoom-out operation. (Suzuki, *e.g.*, 13:55-58.)

Figures 15A-15D show one example of how the frame rate of a video recording is operated at a higher frame rate during a zoom operation:

FIG.15A

ZOOM
OPERATION

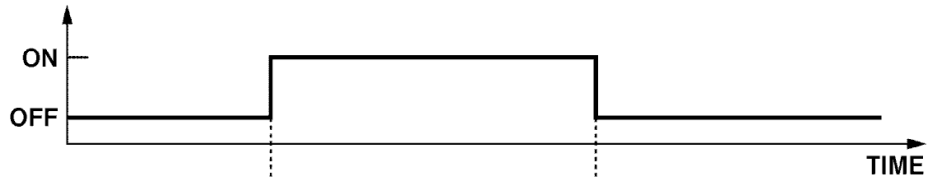


FIG.15B

FRAME RATE
CONTROL
SIGNAL

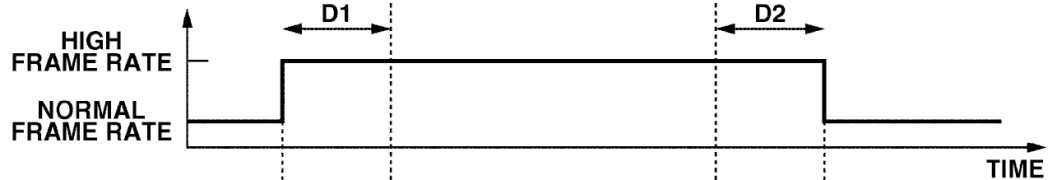


FIG.15C

CAPTURED
FRAMES

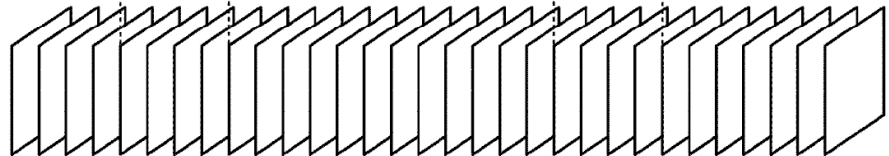
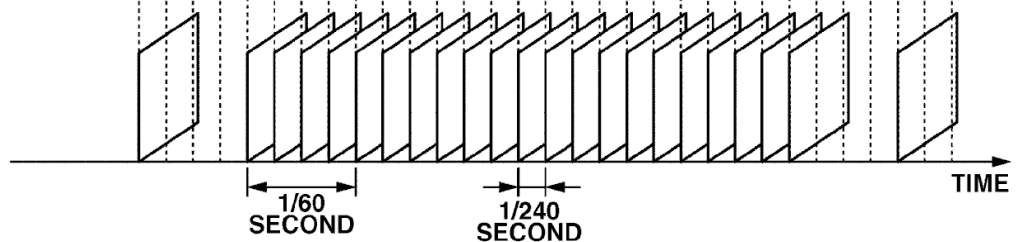


FIG.15D

RECORDED
FRAMES



(Suzuki, Figs. 15A-D.) Figures 15A-D show overlapping timing diagrams in which “the horizontal axis represents time.” (Suzuki, 13:2.) Figure 15A shows a period of time during which a zoom operation takes place during recording. (Suzuki, 13:3-4.) Figure 15B shows that, during a zoom operation, the imaging apparatus operates at a high frame rate. (Suzuki, 13:4-8, 13:13-19.) Figure 15B also shows the ability to operate at a high frame rate for a period before (D1) and after (D2) the zoom operation, in this case, “at a high rate of 1/240-second intervals.” (Suzuki, 13:13-18.) “The lengths of periods D1 and D2 may be different from each other.” (Suzuki, 13:18-19.) As shown in Figure 15D, the end result recording at a frame rate of 240fps for the period during and after (D2) the zoom period. Although not pertinent

here, the particular example in Figure 15D shows frames *captured* during period (D1) at a high frame rate, but when stored as *recorded* frames, they were “thinned” to a lower 1/60-second interval frame rate. (Suzuki, 13:29-32.)

Petitioner need not rely on Suzuki for its particular frame rate implementation, but for its more broadly-applicable teaching of increasing frame rate for video when recording objects that appear closer in the video. As almost anyone who had used a video camera (including a camera on a mobile phone) would have appreciated, zoom-in operations are often performed to focus on a target object in the image – in a sense, to bring that object “closer” to the camera. (Bajaj, ¶176.) Suzuki confirms the desirability of increasing the frame rate in this situation, such as when capturing close-up image information such as facial expressions:

Thus, according to the present exemplary embodiment, in addition to a Zoom operation period, video is recorded in the recording medium **48** at a high frame rate during certain periods before and after the zoom operation period. Generally, when a user carries out a zoom operation, video captured before and after a zoom-in operation or a zoom-out operation includes a target object. Thus, the video includes important scenes that reflect the photographers intention, and examples of such scenes include goal scenes in sports games and close up facial expressions. By recording the video captured before and after a zoom operation at a high frame rate as described above, the video captured before and after the zoom operation can be displayed effectively.

(Suzuki, 13:52-64.) For example, therefore, Suzuki discloses that a frame rate for video can be increased after a “zoom-in” operation, such as after zooming-in on a user’s face, in order to capture and effectively display important information such as “close up facial expressions.” (*Id.*)

Manner, Rationale and Motivation to Combine (Rosenberg, Francois and Vidunas with Suzuki): It would have been obvious to combine Rosenberg, Francois, and Vidunas with the frame rate variation teachings in Suzuki. The combination would have predictably resulted in the system described by the proposed combination of Rosenberg, Francois, and Vidunas in which the frame rate for the video is varied (*e.g.* increased) when the user is closer to the camera. (Bajaj, ¶177.)

It thus would have been obvious, based on the further combination with Suzuki, to *increase* the frame rate for the mirror display system of the proposed combination of Rosenberg, Francois, and Vidunas, when the user is *closer* to the mirror/display. (Bajaj, ¶178.) As explained for limitation 1[g] of **Ground 1**, Francois already discloses determining a distance of the user, expressed as distance *d*. (Bajaj, ¶¶96, 178; Francois, 0023.) Under the proposed combination of **Ground 2**, it would have been obvious to increase the frame rate when the user is closer to the mirror/display (based a reduction in distance *d*), in order to provide greater detail for the video. The increase in frame rate would thus have increased the rate at which the “non-ordered steps” of claim 1 (*i.e.*, capturing digital images

from a camera, flipping images about a vertical axis, applying transformation mappings and resizing the images, and then displaying the images) are performed – thus **“varying rate at which the non-ordered steps are performed on the series of images according to distance.”** (Bajaj, ¶178.)

As noted, Petitioner does not rely on Suzuki for particular details about its zoom frame rate feature, but for its more broadly applicable teaching of the desirability of increasing frame rate when the video is capturing objects that appear to be closer to the camera. (Bajaj, ¶¶176, 179.) The zoom in Suzuki does not physically bring an object closer to the camera, but it does change the angle of view of the camera, magnifying the target object in the image and making it appear closer. Zoom operations were often performed to focus on a target object and thereby bring it “closer” to the camera. (*Id.*, ¶179.)

This is where Suzuki provides a clear motivation to combine to increase the frame rate of video – to improve the quality of videos recording closer-up objects. As noted in the discussion of Ground 1, it was well-known that frame rate can directly impact on the user’s experience viewing a video, with higher frame rates delivering smoother and more natural motion. (Bajaj, ¶¶68, 180.) Suzuki acknowledges a phenomenon that skilled artisans and even laypersons would have immediately recognized – when objects move closer to the viewer (regardless of whether they move physically closer or appear closer because of zooming or

magnification), the viewer can perceive see more detailed information about the object's movements. This observation is true regardless of whether the target object is another person, an insect, the shape of a falling drop of water, or any other object capable of fast or subtle movements. (Bajaj, ¶180.) Using the example of a person, when the person moves closer to a viewer, the viewer can see more detail about the person's movements including body language, facial micro-expressions, and many other subtle movements that may be less perceptible at greater distances. (*Id.*)

Suzuki expressly acknowledges this by explaining increasing frame rate would be warranted to capture "close up facial expressions," such that the information "can be displayed effectively." (Suzuki, 13:52-64.) An ordinarily skilled artisan would thus have been motivated to increase the frame rate when the viewer is closer to the camera, in order to better capture the additional motion that becomes visible when the user moves closer. (Bajaj, ¶181.) A skilled artisan would also have had at least a reasonable expectation of success as altering the frame rate for a recording system was well-known. (*Id.*, ¶183.)

Petitioner acknowledges that under **Ground 1**, the frame rate increases when the viewer moves *farther away* from the mirror/display, whereas under **Ground 2**, the reverse is true. But this difference does not undermine either ground because each is based on different (but separately compelling) motivations. Ground 1 increases frame rate to take advantage of the reduction in image data when the user

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is further away, whereas Ground 2 increases the frame rate to increase video detail for closer objects. These represent valid justifications for varying the frame rate, and an ordinarily skilled artisan may have found one to be more compelling than the other for a particular target system. (Bajaj, ¶182.) For example, the rationale in Ground 1 might be more compelling when computing resources are scarce, whereas Ground 2 might be more attractive to an application that prioritizes video image quality over computing resource considerations. (*Id.*)

VII. CONCLUSION

Petitioner respectfully requests IPR institution.

Dated: January 28, 2022

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE WITH WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that this petition complies with the type-volume limits of 37 C.F.R. § 42.24(a)(1)(i) because it contains 13,987 words, according to the word-processing system used to prepare this petition, excluding the parts of this petition that are exempted by 37 C.F.R. § 42.24(a) (including the table of contents, a table of authorities, mandatory notices, a certificate of service or this certificate word count, appendix of exhibits, and claim listings).

DATED: January 28, 2022

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CERTIFICATE OF SERVICE

I hereby certify, pursuant to 37 C.F.R. Sections 42.6 and 42.105, that a complete copy of the attached **PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 8,982,109 B2**, including all exhibits (**Nos. 1001-1027**) and related documents, are being served via Priority Express Mail on the 28th day of January, 2022, the same day as the filing of the above-identified document in the United States Patent and Trademark Office/Patent Trial and Appeal Board, upon Patent Owner by serving the correspondence address of record with the USPTO as follows:

Womble Bond Dickinson (US) LLP
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P.O. Box 7037
Atlanta GA 30357-0037

And, via Federal Express upon counsel of record for Patent Owner in the litigation pending before the U.S. District Court for the District of Delaware entitled *EyesMatch Ltd. et al. v. Facebook, Inc. et al.*, Case No. 1:21-cv-00111-RGA-JLH (D. Del.) as follows:

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