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Small Form Factor Wide Field of View Augmented Reality Head Mounted Display

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Small form factor wide field of view augmented reality head mounted display.

ABSTRACT

In this disclosure a method to create a wide field of view augmented reality head mounted display which has a small form factor is disclosed. Two transparent video displays are used as front facing main display and two other transparent video displays are used from left and right sides of the front facing main display slightly tilted. A beam splitter is used to combine the real-world view and the computer - generated view. Two overhead displays are used with two convex lenses to project two images into the beam splitter. The result is a small form factor augmented reality head mounted display with a clearly focused smaller central vison region and a larger peripheral region surrounding that central region. The objective is to give a user a clear central field of view and a sensation of the peripheral vision surrounding it.

KEYWORDS

Augmented reality (AR)

Augmented reality head mounted display (ARHMD)

Transparent video display

Beam splitter

Peripheral region

Far peripheral region

Dark tinted transparent screen

BACKGROUND

In todays world augmented reality is used in many sectors. Some of them are education, manufacturing, engineering, gaming and design. Two of the problems augmented reality head mounted displays face are one, there have a limited field of view and two, they are too large and bulky. Due to the second problem mentioned, there is no good social acceptance to wear an augmented reality head mounted display in the outside in the public.

DESCRIPTION

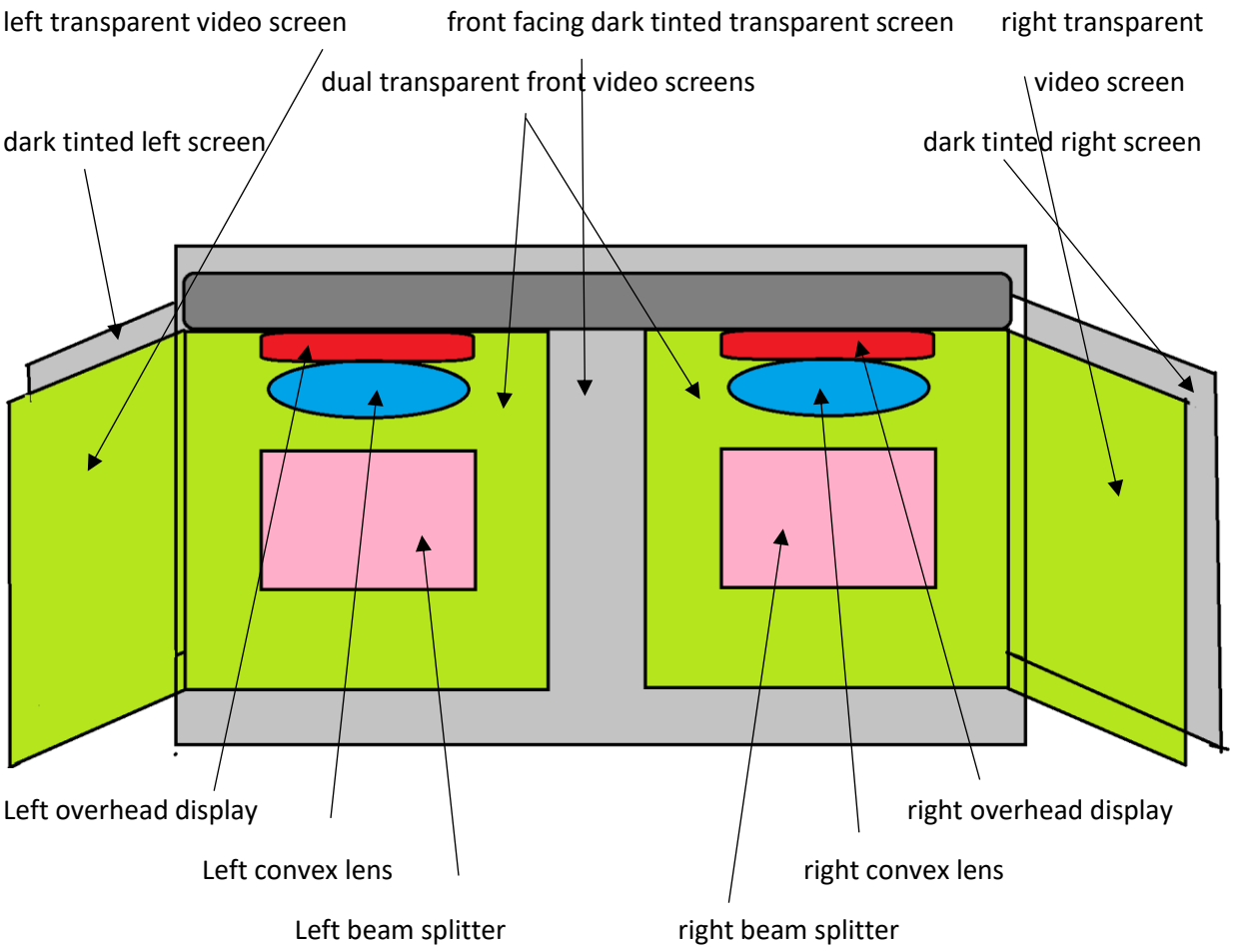
The ability to have a comparatively small form factor augmented reality head mounted display with a large field of view has several advantages. They are listed below.

1. Having a large field of view enables to see a larger portion of viewable area compared to a head mounted display with a smaller field of view.
2. This also prevents the effect of the user experiencing the computer-generated view as seeing through a narrow window.
3. Due to having a large field of view the user will be able to see the computer simulated virtual world all around him rather than only visible on a small portion of the field of view which makes the experience more natural and pleasing.
4. The small form factor makes it more portable.
5. The small form factor makes it looks more nice looking making it more socially acceptable.
6. Due to the advantage mentioned in 5. It will enable the usage of the head mounted device outside in the society.

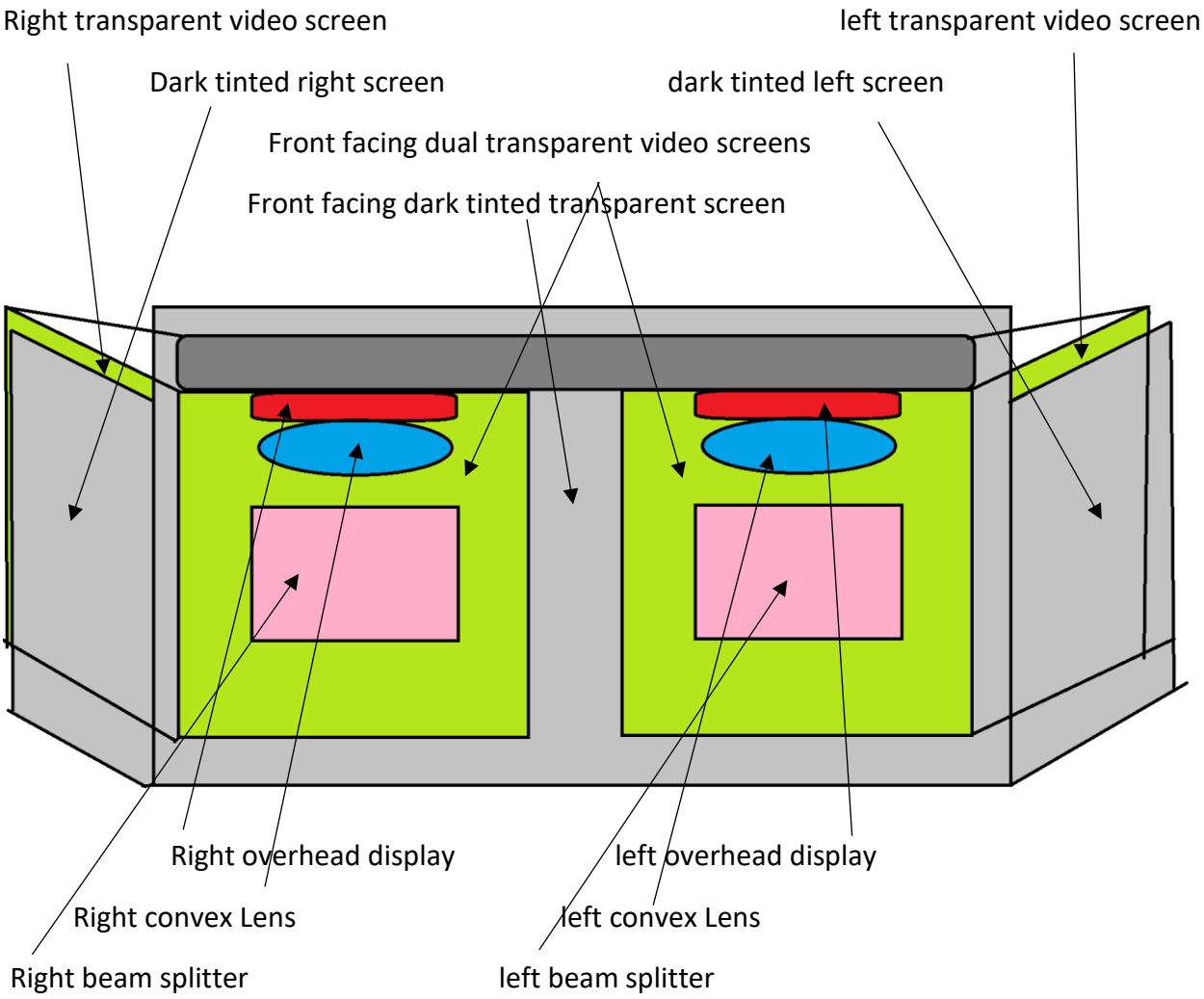
augmented reality head mounted display.

Perspective Diagrams

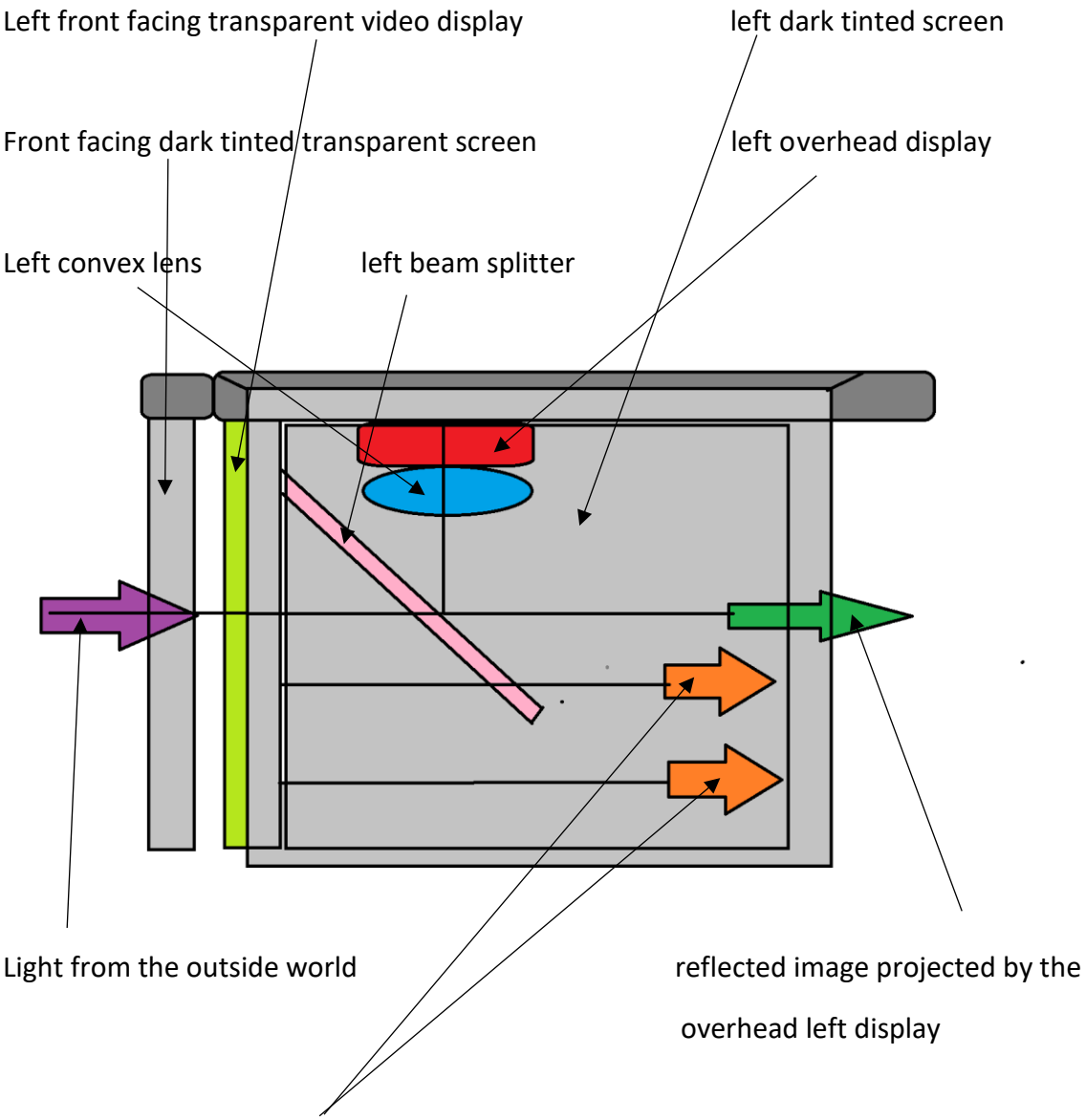
1: the rear view



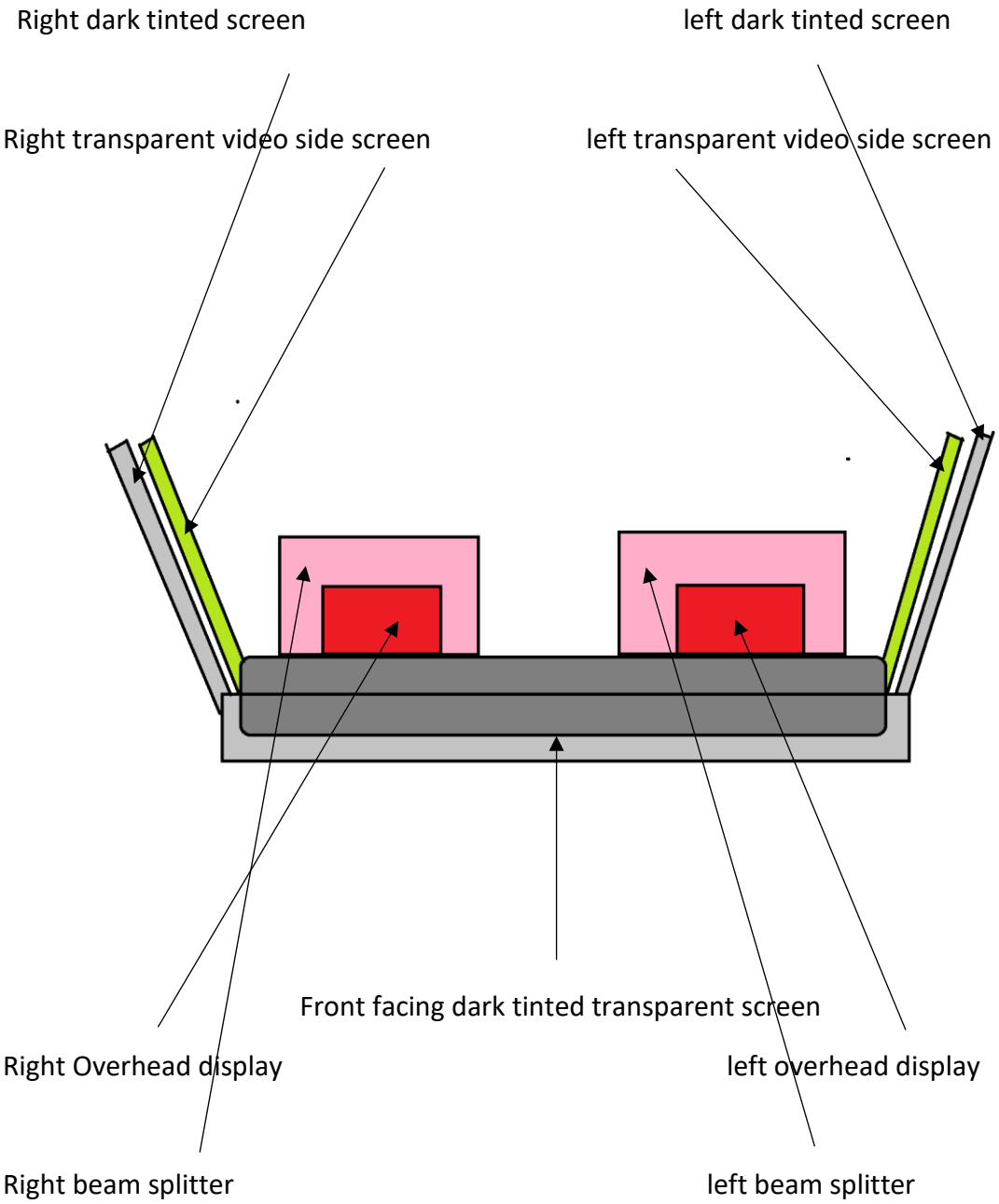
2: The front view



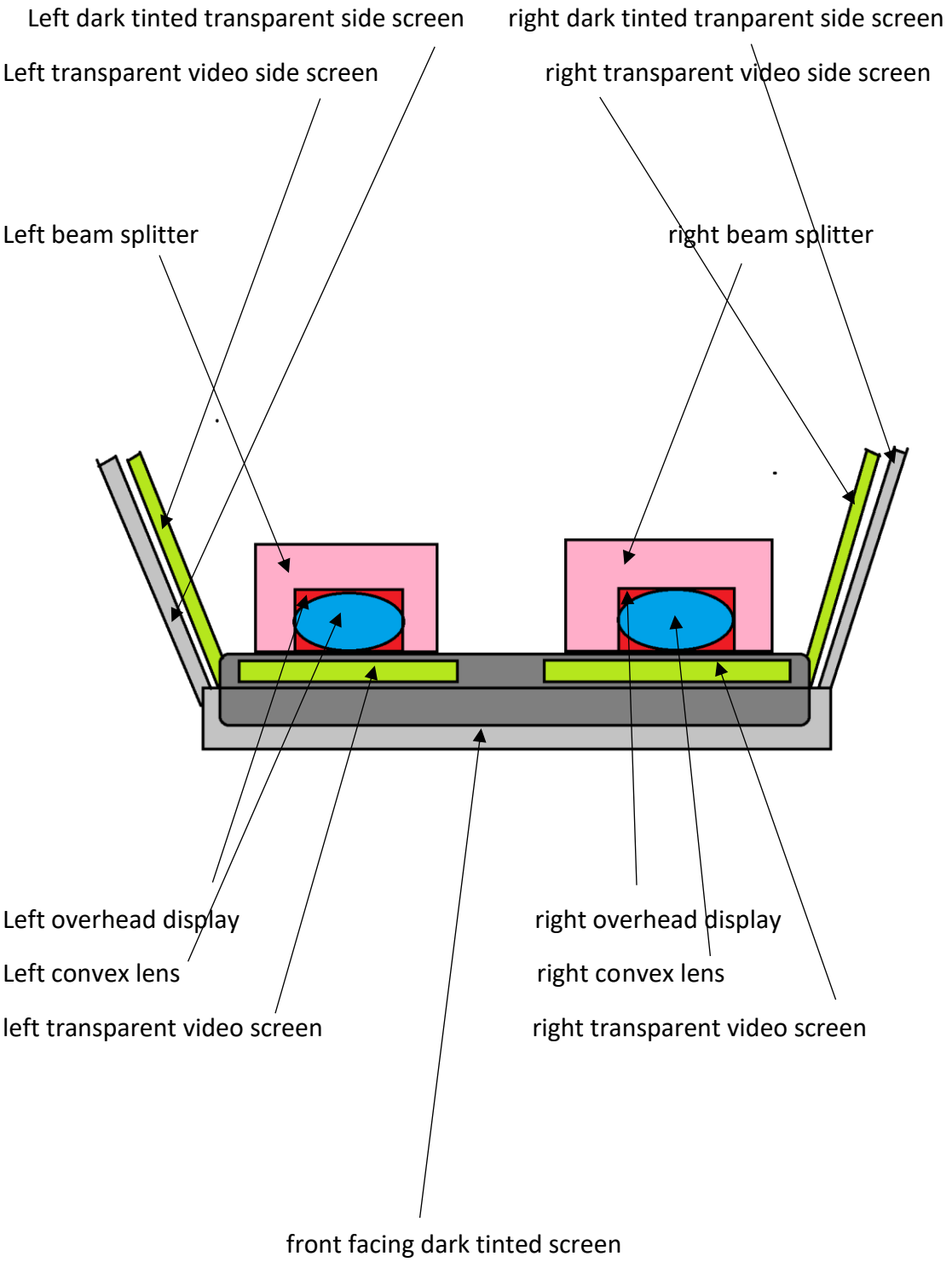
3: The left side view



4: The top view



5: The bottom view



Description of the parts of the head mounted augmented reality display.

Part1.

The overhead dual display screens. – in red color. These two displays are fitted horizontally overhead. The purpose of the two displays is to provide the two images that would be projected onto the beam splitter after being focused by the two convex lenses.

Part2. The dual convex lens system – in blue color.

The two convex lenses focus the projection of the overhead two screens onto the beam splitter.

Part3. The dual 45 degrees angled beam splitter glass – in pink color.

These are two beam splitters tilted at 45 degrees so that they could let the user view both the reflection of the overhead two screens' projection focused by the two lenses and the light rays from the outside world.

Part4. The front facing main dual transparent video displays-in green color.

This is a transparent video display that is fitted in front of the beam splitter. Part of the central portion of this transparent display is not lit so that it would not display images because that portion is used by the beam splitter to project the image to the user's eyes. The purpose of this display is to give the user a sensation of the peripheral regions surrounding the region of view provided by the reflected projection by the beam splitter without actually focusing on those regions.

Part5. The dark tinted front facing transparent screen – in grey color.

This screen shields the front of the ARHMD from the outside world. By doing so it will darken the view of the outside real world seen by the user blocking out bright light. This effects in the two images, one that is reflected by the beams splitter and the one that is displayed on the front facing transparent video screen to appear brighter rather than dimmer.

Part6. The transparent video screens that resides on the two sides of the head mounted display-in green color.

These two video screens reside on the left and right side of the head mounted display. Their purpose is to provide the user with the sensation of the far peripheral regions of the human field of view.

Part7. The dark tinted two transparent screens that resides on the two sides of the ARHMD which are fixed in front of the two transparent video screens on the sides-in green color.

Their purpose is to shield the two transparent video screens from the bright light from the outside world. The effect of this is that the image produced by the two transparent video screens that provide the user with the sensation of the far peripheral field of view appears brighter rather than dimmer.

The method description

This disclosure describes a methodology to create an augmented reality head mounted display that enable the users to experience a clearly focused central vision and the sensation of the greater peripheral regions surrounding that central vision including far peripheral regions while keeping the device to a comparatively smaller form factor. This is achieved by combining three types of image projections. The three types are listed below.

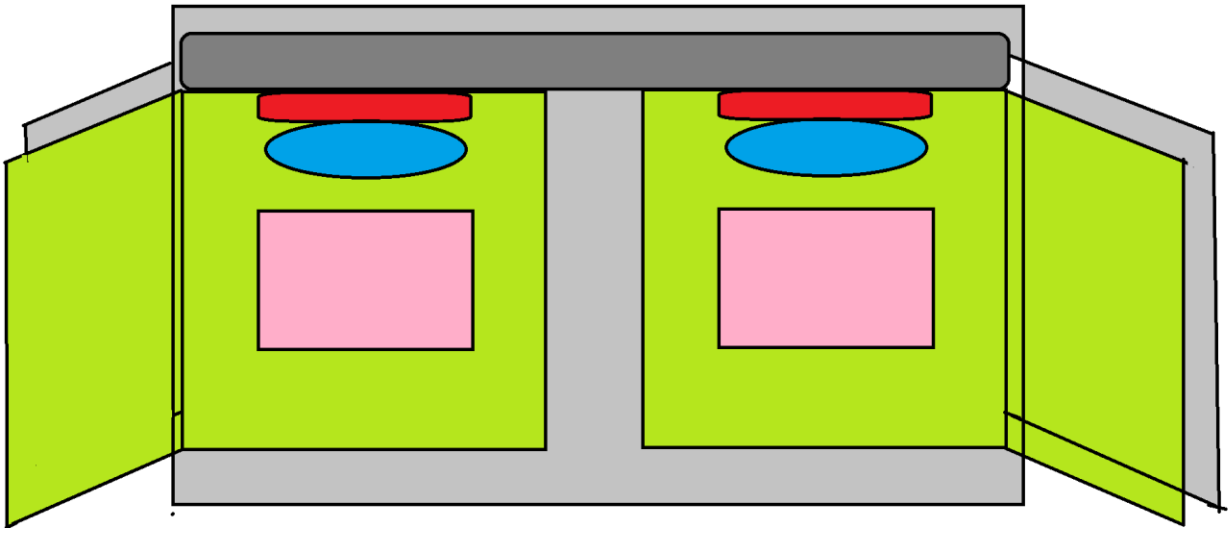
First type: the central vision image projection

Second type: peripheral vision projection surrounding the central vision mentioned in the first type

Third type: far peripheral vision projection

And their descriptions are given below.

First type: the central vision



1: rear view

Red color – overhead video displays blue color- convex lenses

Pink color – 45 degrees tilted beam splitter

Green dual screens in the middle of the ARHMD- dual transparent video screens

Green dual screens on the sides one each- dual transparent side video screens

Grey area in the center – the dark tinted transparent screen

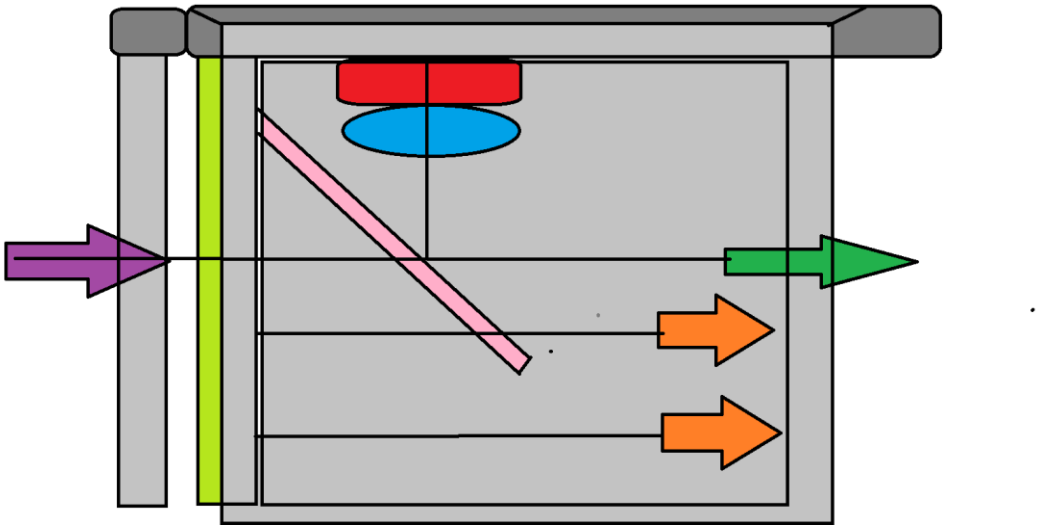
Grey area on the sides – the dark tinted transparent side screens

Referring to 1: rear view diagram

The two overhead video displays are used to create two images which are let to project onto another two overhead convex lenses which are fixed below the two video displays. The two convex lenses focus the image produced by the two video displays in a way that is viewable by the eyes of the user wearing the ARHMD.The image focused by the two convex lenses then gets projected onto the 45 degrees angled dual beam splitter. After that the image projection gets reflected by the dual beam splitter at 90 degrees angle and travels towards the user's eyes.

This reflection of the projection at 90 degrees angle is shown by the diagram 3: the left side view below.

Diagram3:left side view



Red color – the left overhead video display screen

The pink color – left beam splitter tilted at 45 degrees angle.

Blue color- the left convex lens

Green arrow – the projection of the image that gets focused by the convex lens and then reflecting off the beam splitter at 90 degrees and heading towards users' eye.

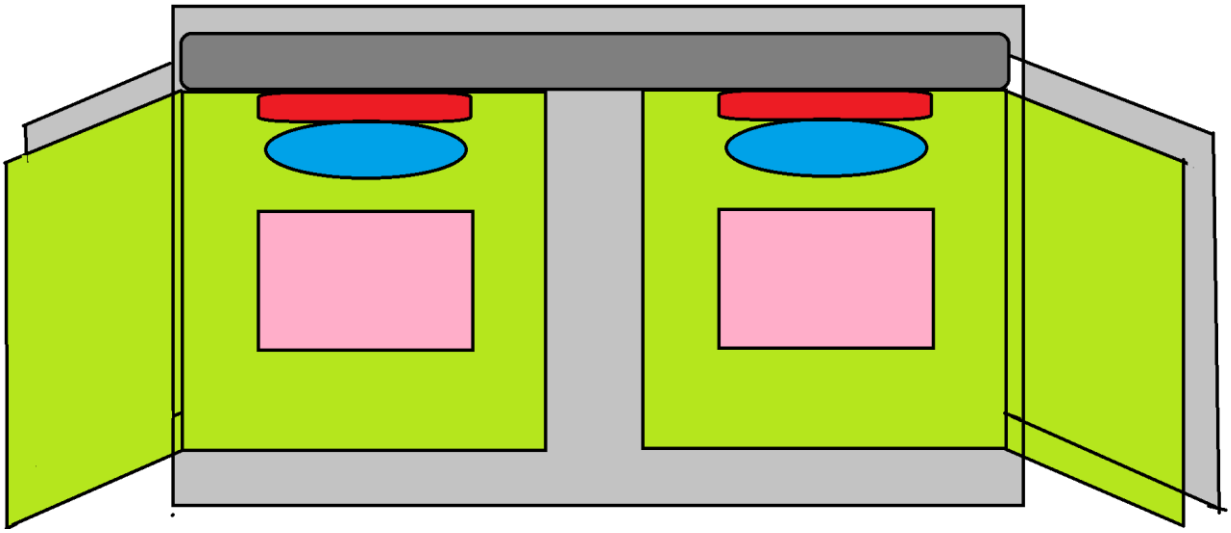
Light green -the left front facing transparent video display

Since there are two video display screens, two convex, lenses and two beam splitters two focusable images gets projected into the two eyes of the wearer of the ARHMD. The central vision consists of these two image projections.

Second type: peripheral vision projection surrounding the central vision mentioned in the first type

As shown in the diagram above, as indicated by the light green color, the front facing left transparent video display displays an image with the central part of the image not illuminated by pixels. This non illuminated part corresponds to an area of size occluded by the image projected onto the beam splitter. The objective of this configuration is to let the user experience a clearly focused central vision while experiencing the sensation of an unfocused surrounding greater peripheral vision. the un focusable nature of the greater peripheral region will not hinder the users experience of the computer simulated virtual world because most of the time the wearer of the ARHMD will be looking forward in direction without rotating the eyeballs to any other direction around and a clear central focusable vision is already present for the user to view.

Third type: far peripheral vision projection



Red color – overhead video displays blue color- convex lenses

Pink color – 45 degrees tilted beam splitter

Green dual screens in the middle of the ARHMD- dual transparent video screens

Green dual screens on the sides one each- dual transparent side video screens

Grey area in the center – the dark tinted transparent screen

Grey area on the sides – the dark tinted transparent side screens

As seen in the above diagram the green indicated two screens on the left and right side provides the viewer the virtual surroundings of the far peripherals of the field of view.

In this method the three types of image projections projected by the three types of vision mentioned above are combined to produce to give the user a clearly focused central vision and the sensation of the surrounding greater peripheral regions including the far peripheral regions.

In addition to this configuration dark tinted transparent screen set is fixed so that they cover the entire field of view covered by the above combined image projection. These dark tinted transparent screens are shown in grey color in the above diagram. Their purpose is to shield the ARHMD from the outside world's bright light so that the computer generated imagery produced appear bright and clear.

Effectively the user will be able to enjoy a computer simulated virtual world as an undisturbed experience of a large continuous human field of view from a comparatively smaller form factor ARHMD.