# Heliodisplay

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*Abstract*— **Heliodisplay is a hi-tech projector that displays pictures in the air which is a free-space display developed by I02 Technology. A projector is focused onto a layer of mist in mid- air, resulting in a two-dimensional display that appears to float. As dark areas of the image may appear invisible, the image may be more realistic than on a projection screen. Heliodisplay can work as a free-space touch screen when connected to a PC by a USB cable. A PC sees the Heliodisplay as a pointing device, like a mouse. With the supplied software installed, one can use a finger, pen, or another object as cursor control and navigate or interact with simple content. No special programming is required as this works like a standard mouse driver**.

*Keywords—Heliodisplay,* **fog screen**, *IO2 technology, heat pump, prior art ball lens, viewing angle, virtual forest.*

## I. INTRODUCTION

Even though modern technology has invested millions, even billions, in projection screen technology, high definition projectors, and even projectors for our cell phones, we have forgotten that we will always need something to project on. Unfortunately, with the tragic proliferation of advertising these days, we are probably looking at a future world where all the space in the buildings is taken for billboards and other various projected ads. The only place that would not be taken is the spaces that people walk through. However, that is an option that we can use, with the **Heliodisplay** (Fig.1) projector.

Fig.1 Heliodisplay.

Current technologies attempt to create the visual perception of a free-floating image through the manipulation of depth cues generated from two-dimensional data employing well-established techniques. A few examples of these include stereoscopic imaging via shutter or polarized glasses, as well as auto-stereoscopic technologies composed of lenticular screens directing light from a conventional display, or real-imaging devices utilizing concave mirror arrangements. All of these technologies suffer convergence and accommodation limitations. In order to resolve this visual limitation, the image and its perceived location must coincide spatially. A well-established method solving this constraint is by projection onto an invisible surface that inherently possesses a true spatially perceived image location. In late 2003, a small company from the San Francisco Bay Area demonstrated a unique revolutionary display technology. The prototype device projected an image in thin air just above it, creating an illusion of a floating hologram. The development of this distinctive technology, dubbed Heliodisplay by its developer Chad Dyner, began early this decade after Dyner decided to trade a promising career as an architect to become an inventor. Dyner bought an ordinary digital projector, took it apart, and spent entire days trying to figure out a way to stop in midair the light coming from the projector without engaging a traditional screen.

Fig.2 Floating display using Heliodisplay

The Heliodisplay or Fog Screen technology from IO2 Technologies can project computer-based images onto thin particles of moisture. The airborne film of moisture generated by the device (the black box with the large slot pictured in the foreground) captures the light from the projector to allow the images to take shape. Shown here (fig.2), the laptop in the background is running a video of a woman on a Cell phone, while the Heliodisplay simultaneously turns it into an image that appears to be floating in thin air. Displaying an image using conventional projectors requires a non-transparent medium, typically screens, walls, or even water, but air, which is transparent, cannot be used. A more recent development is the Fog Screen, which creates an image in midair by employing a large, non-turbulent airflow to protect the dry fog generated within from turbulence. The result is a thin, stable sheet of fog, sandwiched between two layers of air, on which an image can be projected and even walked through. The Heliodisplay creates a similar effect, but, instead of fog, it uses a cloud of microscopic particles whose specific nature is one of the secrets Dyner keeps close to the vest. In 2005, the U.S. Patent Office granted Dyner a patent for a "method and system for free-space imaging display and interface". Apparently, the Heliodisplay creates a particle cloud by passing the surrounding air through a heat pump, which in turn cools the air to a level below its dew point, where it condensates, and is then collected to create an artificial cloud. The particle cloud is composed of a vast number of individual micro droplets, between 1-10 microns in diameter, too small to be visible to the naked eye, held together by surface tension. The focus and illumination intensity of the projected image can be controlled by changing some of the cloud's properties, enabling a sharper and brighter image.

The Heliodisplay projects computer-based images onto thin particles of moisture generated by a particulate emitting device. The moisture film generated by the device captures the light from the projector to allow the images to take shape. Since 2003, IO2 Technology, the California-based company Dyner founded to commercialize his invention, began selling his device under the brand name Heliodisplay M2 for just under $20,000 out of reach of most consumers. IO2 stands for the second-generation I/O interface or input-output esoteric used in the computer world where digital information and the real world co-meet and information goes into or out from a computer. IO2 Technology is actually marketing the M2 to corporate customers who would use the device as a novel way to display the company's logo or as a strikingly impressive advertising and promotional tool for exhibitions. The Heliodisplay from IO2 Technologies can project any kind of static or moving image, from photographs to movies, without the need for a solid screen. Pictured here, Fig.3 is an arrow icon appears suspended in the air in front of a person's hand. The user can interact with floating images or video, and manipulate them as you could with a mouse, including clicking and dragging. With the lightest of touches, users can grab and shuffle images around, zoom in and out to see the minutest of details, or simply wave their hands over an image to make it come alive with screens as large as 100 inches or 254 centimeters.

## II. TYPES OF DISPLAYS

In present scenario there are many variety of displays available in the market, some of them are as given below-

### *A. Head-mounted displays*

Fig.3 an arrow icon appears suspended in the air

Traditional augmented and virtual reality often uses head-worn, tracked displays which draw virtual images directly in front of the user's eyes. World-stabilized 3D objects are possible using position and orientation head tracking to always draw objects from the correct point of view for the user. More sophisticated displays present different left and right images for stereo separation effects, but in general focal length remain constant across the entire image. These setups typically only provide a private image which cannot be seen without cumbersome user-worn equipment - collaboration requires each user wears separate display hardware. Artifacts such as misregistration and lag are commonly experiencing problems that detract from the sense of presence in the virtual or augmented reality scene and may cause eyestrain, headache, and other discomforts.

### *B. Volumetric displays*

While head-worn displays attempt to create the appearance of virtual objects within some work space, volumetric displays actually create the 3D image of a surface within a volume. The surface can be viewed from arbitrary viewpoints with proper eye accommodation since each point of light has a real origin in 3D. Tracking of the viewer is not necessary. Volumetric displays are based on a broad and diverse collection of various methods, technologies and ideas. Numerous techniques incorporating e.g., fiber optics, mirrors or oscillating screens, have been developed to achieve this effect. Traub's display creates a virtual image by varying the focal length of a mirror to produce a series of 2D images at different apparent depths. A real 3D image is generated by Actuality Systems' Perspecta display, which draws 2D images on a quickly rotating screen to fill the entire volume swept out by its path. The Depth Cube Z1024 display takes yet another approach, using 20 stacked LCD panels to light 3D points in space without any moving parts.

Unfortunately, these displays all create their 3D imagery in a fairly small enclosed volume that the viewer cannot enter. They are more suited for computer graphics than video applications due to the difficulty in capturing suitable natural imagery in 3D. One drawback is typically image transparency where parts of an image that are normally occluded are seen through the foreground object. Yet another difficulty that could give an unrealistic appearance to natural images is that of the inability to display surfaces with a non-Lambert ion intensity distribution.

### *C. Large translucent displays*

The Holoscreen and the Holoclear displays make the screen practically transparent from the viewer's point of view, showing only projected objects. They are examples of screens that consist of an acrylic plate that is coated with a holographic film, such that it catches only light that is projected from a 30-35 degree angle. A bright and clear image can thus be obtained in daylight conditions, while the display is transparent from the opposite side. These types of transparent displays are single-sided and not penetrable. When a projection system is combined with user tracking and a large semitransparent display, the result is a projection-based optical see-through AR system. A serious limitation of such a setup, however, is its inherent single.

*D. Immaterial displays*

There have been several displays using water, smoke or fog, with an early example presented by the Ornamental Fountain from the end of the 19th century. More recently, water screen shows such as Water Dome, Aquatique Show and Disney's Fantastic, spray sheets of freely flowing or high-velocity water to create impressive displays for large audiences. The magnitude and wetness of these screens, as well as their large water consumption, make them impractical for indoor or small-scale applications, as well as to preclude the viewers from comfortably passing through the display space and seeing crisp images from short distances. However, these water screens may be large and look good if viewed from afar and on-axis. Many types of fog projection systems have been used for art and entertainment purposes, but the rapid dispersion of the fog seriously limits the fidelity of projected images. The dispersion is caused by turbulence and friction in the fog's flow, which disrupts the desired smooth planar surface, causing projected points of light to streak into lines. This streaking causes severe distortion of the image from off-axis viewing angles.

*E. Perspecta*

Perspecta is another unique display technology, developed by Actuality Systems. Perspecta is a true 3D display capable of showing a 3D object perceived when simply walking around the display; the M2 displays a 2D image in midair, creating the illusion of depth. While the Perspecta is currently used mainly for medical and research purposes, the M2 is intended primarily for corporate use as a promotional or advertising tool at this stage. Although it is possible to view movies or play games on the M2, Dyner admitted that the current device is not intended for serious applications such as CAD (computer-aided design). The Perspecta is an enclosed device with lower resolution but with the capability to display a full 3D image and video with almost no flickering or wavering effects. A future display might incorporate the best of both worlds: an open-air display with high resolution, clear 3D capability, along with an accurate interactive capability.

Fig.4 Perspecta

## III. BASIC UNITS & WORKING

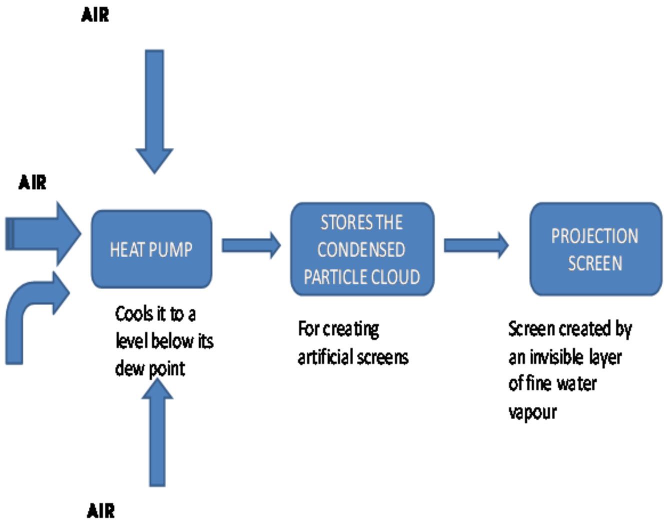


Fig.5 Basic Unit

The Heliodisplay looks high-tech, but it relies on fairly simple technologies. The Heliodisplay transforms ambient air using a proprietary multi-stage system of modifying the optical characteristics within a planar region in which polychromatic light is scattered on this surface such that the image appears visible to the viewer. An advanced optical tracking system monitors finger movement within in the image region and is translated into cursor control movements, enabling the Heliodisplay to be utilized both as an Input & Output device in two-dimensional space.

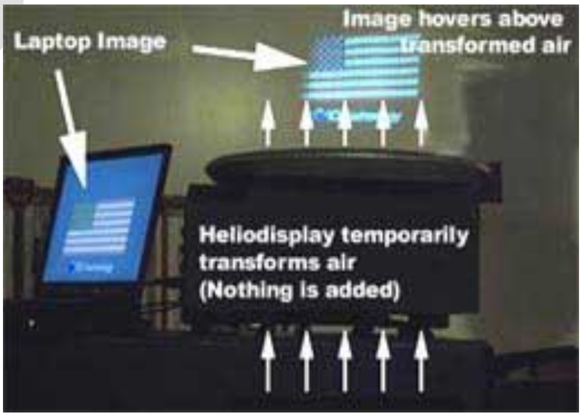


Fig.6 The image manipulation using Heliodisplay

The fig.6 image manipulation using Heliodisplay comes courtesy of a row of infrared light emitters positioned just in front of where the water vapour emerges. The system senses when your finger breaks through the infrared beams and interprets your movements in a way not dissimilar to a touch-sensitive screen.

The preferred embodiment of the invention extracts moisture from the surrounding air through a heat pump extraction device, utilizing solid-state components such as thermoelectric (TEC) modules, compressor-based dehumidification systems or other means of creating a thermal differential resulting in condensation build-up for subsequent collection. Extraction device can be divorced from the main unit to a separate location, such as over the particle cloud. The extracted condensate is stored in a storage vessel, which can include an external connection, for additional refilling or for operation without extraction device. The condensate is sent to a particle cloud manufacturing system, described further in the document, which alters the condensate by mechanical, acoustical, electrical or chemical means, or a combination of one or more means, into microscopic particle cloud material. Particle cloud delivery device ejects the microscopic particle cloud material locally re-humidifying the surrounding air, creating an invisible to near-invisible particle cloud screen, contained within a controlled microenvironment. Controller and sensor adjust screen density (number of particulates per defined volume), velocity and other parameters of particle cloud. External ambient conditions such as temperature, humidity, and ambient lighting are read by sensors, and sent to the controller, which interpret the data and instruct the particle cloud manufacturing system to adjust the parameters, ensuring an effective invisible to near-invisible screen for imaging.

Signals originating from an external source, a VCR, DVD, video game, computer or other video source, passes through optional scan converter, to the processing unit, to decode the incoming video signal. Stored video data, contained for example on a hard disk, flash memory, optical, or alternate storage means, can be employed as the source of the content. The processing unit, receives these signals, interprets them and sends instructions to graphics board, which generates video signal, which is sent to an image generating means, producing a still or video image. The image generator comprises a means of displaying still or video data for projection, which may be a laser based means of directing or modulating the light from any illumination source used to generate a still or video image. Components may also be replaced by a video projector in a simplified embodiment.

In the preferred multisource embodiment, a single projection source includes a multi-delivery optical path, comprising a series of lenses, prisms, beam splitters, mirrors, as well as other optical elements required to split the generated image to “phantom” source locations surrounding the perimeter of the device and redirect the projection beam onto the particle cloud. In an alternate multi-image generation embodiment, multiple images are generated on either a single image generator, such as one projection unit or a plurality of them, and are directed, using a single optical delivery path, or multiple delivery paths using multi-delivery optics, splitting and recombining the projection. In all instances, the directed projection illuminates the particle cloud, where a free - space image appears to be floating in the protective microenvironment within the surrounding air. Microenvironment functions to increase boundary layer performance between the particle cloud and the ambient surrounding air by creating a protective air current of similar ejection velocity to that of particle cloud. This microenvironment and particle cloud characteristics can be continuously optimized to compensate for changing environmental conditions, in order to minimize cloud visibility, discussed in further detail below.

In the interactive embodiment, coexisting spatially with image is an input detectable space, allowing the image to serve as an input/output (I/O) device. Physical intrusion within the input detectable space of particle cloud, such as a user's finger, a stylus or another foreign object, is recognized as an input instruction. In its preferred embodiment, reflected light scattered off the user's finger or other input means is captured by optical sensors.

The sensor is capable of filtering unwanted ‘noise’ by operating at a limited or optimized sensitivity response similar to or equal to the illumination source wavelength either by employing a specific bandwidth sensor, utilizing band-pass filters or a combination of both. Light beyond the frequency response bandwidth of the sensor is ignored or minimized, diminishing background interference and recognizing only intentional input. The coordinates in space where the intrusion is lit by the illumination source corresponds to an analogous two or three-dimensional location within a computer environment, such as in a graphic user interface (GUI) where the intrusion input functions as a mouse cursor, analogous to a virtual touchscreen. The highlighted sensor captured coordinates are sent to the controller, that read and interpret the highlighted input data using blob recognition or gesture recognition software at processing unit, or controller.

In its preferred embodiment, this invention operates solely on a power source independent of a water source by producing its own particle cloud material. By passing the surrounding air through a heat pump, air is cooled and drops below its dew point where condensate can be removed and collected for the cloud material. One method well known in the arts comprises a dehumidification process by which a compressor propels coolant through an evaporator coil for dropping the temperature of the coils or fins and allows moisture in the air to condense while the condenser expels heat. Other variations include extracting elements from the ambient air such as nitrogen or oxygen, as well as other gases, to manufacture super cooled gases or liquids by expansion, and as a result, create the thermal gap to generate the condensate cloud material. Another method includes electrochemical energy conversion, such as is employed in fuel cell technology, consisting of two electrodes sandwiched around an electrolyte in which water and electricity are produced . Oxygen passing over one electrode and hydrogen over the other generates electricity to run the device, water for the cloud material and heat as a by-product.

The particle cloud composition consists of a vast number of individual condensate spheres held together by surface tension with a mean diameter in the one to ten micron region, too small to be visible individually by a viewer, yet large enough to provide an illuminated cloud for imaging. The focus and controlled illumination intensity onto the overall cloud, allow the individual spheres to act as lenses, transmitting and focusing light at highest intensity on-axis, whereby the viewer views the image at its brightest and clearest. In the multisource embodiment, the directing of light from multiple sources onto the particle cloud ensures that a clear image is viewable from all around, providing continuous on-axis viewing. The on-axis imaging transmissivity of the cloud screen coupled with the multisource projection insure a clear image, regardless of the viewer's position and compensates for any aberration caused by the turbulent breakdown of the cloud. . Intersecting light rays from multiple sources further maximize illumination at the intended image location by localizing the sum of illumination from each projection source striking the particle cloud imaging location. Similarly, multisource projection further minimizes the individual projection source luminosity allowing the viewer to view directly on-axis without being inundated with a single high intensity projection source, as found in the prior art. Fig.7 shows the optical properties of a prior art ball lens, analogous to a single spherical cloud particulate; where D is the diameter of the near perfect sphere of the particulate formed naturally by surface tension. The incoming light follows along path (E), and at resolution (d), is diffracted as it enters sphere (X), and is focused at a distance EFL (effective focal length) at point (Y), on-axis (E), from the center of the particulate (P), at maximum intensity on axis(Y).This process is repeated on adjacent particulates throughout the depth of the cloud and continues on-axis until finally reaching viewer position (Z). The particle cloud exhibits reflective, refractive and transmissive properties for imaging purposes when a directed energy source illuminates the particle cloud.

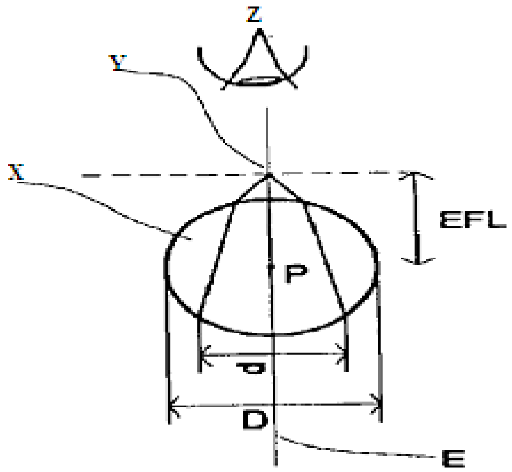


Fig.7 optical properties of a prior art ball lens

## IV. MODELS OF HELIODISPLAY

### *A. M1*

The original M1 units produced by IO2 were advanced prototypes and proof-of-concept, but a few were sold to early adopters through channels such as eBay**.**

### *B. M2*

The M2-series is the second-generation mid-air projector with a larger 30-inch diagonal (76cm) display area with 16.7 million colours and a 2000:1 contrast ratio. The new M2 has been redesigned enabling higher image quality, resolution, brighter and overall performance. The interactive M2i version includes virtual touchscreen capability. The M2 is about the size of a tower desktop computer case turned on its side. The M2 projects its 76.2 cm (30") diagonal floating image at a height of 71 cm (28") above the projector. The native resolution of the M2 is 800 x 600 though it can support up to 1280 x 1024, and the image can be viewed from as much as a 150 degrees angle. The M2i model includes a proprietary system, called Heliocast, for interactively controlling the displayed image and drivers for a standard PC. A sensor inside the M2 identifies the movement of the user's hand in the area of the projected image and the Heliocast software calculates the movement of the object projected**.**

### *C. M3 & M30*

The new third-generation M3 version launched on February 28th 2007.It has the same basic specifications as the M2 but is said to be much quieter, with improved brightness and clarity and more stable operation with an improved tri-flow system. Apart from displaying at a standard ratio of 4:3 in addition it also displays 16:9 widescreen ratio. The native resolution of the M3 is 1024 x 768 and contrast ratio is 2000:1. There is also an interactive version called the M3i. M3i, which in addition to all the features of the M3, serves as a computer input device for cursor control in a desktop environment, for a price of $19,400 USD.The M30 is the updated version of the M3, which fits into the current model numbering system, 30 designating the diagonal screen size.

### *D. M50 and M100*

In late 2007, IO2 Technology introduced two larger Heliodisplays, the M50 and M100. The M50 has a 50" diagonal image, equivalent to displaying a life-size head-and-shoulders person. The M100 has a 100" diagonal image, equivalent to displaying a large full-body person (about 2 meters tall).

### *E. P-SERIES*

P-series Heliodisplay Projection systems are designed with simpler operation functionality and advanced controls for integrating and use. P-series incorporate an optical sync between components that they are in direct communication link so only one button or trigger is required to operate as they all turn on and shut down in sync. Communication ports allow for the helio projection and helio base to be controlled remotely in an installation via a remote controller or PC. Onboard diagnostic features support timing and other advanced independent controls via a controller or PC. Built in gesture control allows even simpler operation, such as hand waving to turn on the unit without actually touching the device. To project the images and videos, air should be touched. The PRX2 projection unit includes proprietary baffling to reduce the viewing of the light source and beam-steering optics shorten the throw distance by 10"(25cm) while simultaneously allowing for easy control of the projection angle without even moving the projection. In addition, and only available in the in the P92", the base system can operate in any orientation from 0-180 degrees. It also has USB playback from projection unit.

## V. FEATURES

i. Heliodisplay projects still images or dynamic images, text or information data onto an invisible to near-invisible particle cloud screen surface. The particle cloud exhibits reflective, refractive and transmissive properties for imaging purposes when a directed energy source illuminates the particle cloud.

ii. Heliodisplay images are not holographic although they are free-space, employing a rear projection system in which images are captured onto a nearly invisible plane of transformed air.

iii. The M2i Heliodisplay can run for up to 10 hours on 2 litres of water and can display at resolutions of up to 1,280x1,024 pixels.

iv. Conventional displays have the benefit of being enclosed in solid frame or case with lights shining directly towards the audience. The Heliodisplay projections are suspended in thin air, so you will notice some waviness to the screen stability and the intensity and clarity of the image is subject to ambient light conditions and optimization of display settings. Although Heliodisplay images are easily viewed in an office environment, this system is unique, and therefore has to compete with its surroundings, so contrast becomes paramount for optimal viewing.

v. Dark background emphasizes the contrast of the image and is highly encouraged when designing a location to view the display. As dark areas of the image may appear invisible, the image may be more realistic than on a projection screen, although it is still not volumetric. Viewing any type of display in direct sunlight is almost impossible and also applies to the Heliodisplay. The darker the room, the better is the result. For the best result, a dark background is highly recommended.

vi. Like any rear projection system, the images are best seen within 70 degrees to either side (fig.8). The necessity of an oblique viewing angle (to avoid looking into the projector's light source) may be a disadvantage Viewing requires no special glasses.

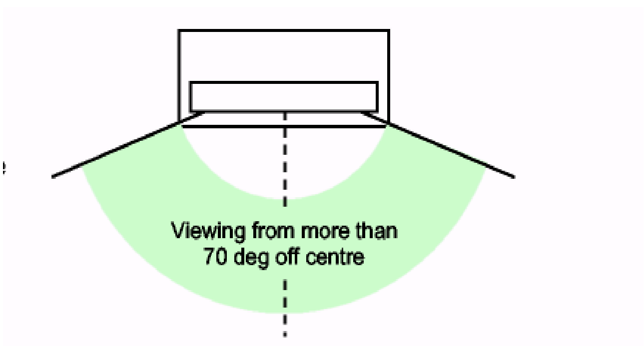


Fig.8 Viewing Angle

vii. Operating the device will not change a room's environment, air quality or other conditions. Air comes into the device, is modified then ejected and illuminated to produce the image .Some projection systems changed the operating environment by over-saturating the surrounding ambient air with particulates, such as humidity or other ejected gases. The present invention employs condensate extraction method specifically to serve as a self-sustained particle cloud manufacturing and delivery system. The Heliodisplay uses no additives or chemicals, only plain tap water (you can also use distilled water, ionized water or demineralised water if desired). The screen is safe for human interaction and will not cause any harm of any kind. If a Heliodisplay were left running for a week in a hermetically sealed room, the only change to the room's environment would be from the electricity used to run the device.

viii. The multiple projection source of this invention has the capacity to produce multi-imaging; were discrete images projected from various sources can each be viewed from different locations. The multiple projection source of this invention has the capacity to produce multi-imaging; were discrete images projected from various sources can each be viewed from different locations. In addition, the multisource projection redundancy mitigates occlusion from occurring, such as in the prior art, where a person standing between the projection source and the screen, blocks the image from being displayed.

ix. By projecting from solely one side, the display can also serve as a one-way privacy display where the image is visible from one side and mostly transparent from the other side, something not possible with conventional displays such as television, plasma or computer CRT's and LCD monitors. Varying the projected illumination intensity and cloud density can further attenuate the image transparency and opacity, a function not possible with existing displays. The display can also take on varying geometric shapes, generating particle cloud surfaces other than a flat plane, such as cylindrical or curved surfaces. For these particle cloud types adaptive or corrective optics allow compensate for variable focal distances for the projection.

x. The Heliodisplay is interactive, like a virtual touch screen. A hand or finger can act as a mouse. It is possible to access any Windows XP programme by pointing, clicking, writing, or drawing in the FogScreen using only your hand. When you touch an image on the airborne interactive screen, the coordinates are forwarded to a PC as a double-click.

## VI. SPECIFICATIONS

1. Image Size: 30 measured diagonally (4:3 aspect)
2. Interactivity: Virtual Cursor Control ± Heliocast ver. 2.0
3. Aspect Ratio: 4:3 or 16:9
4. Resolution: Native ± SVGA 800×600 pixels; Resize Support: 640×350 to 1280×1024 pixels
5. Contrast Ratio: 2000:1 (at projection source)
6. Color Reproduction: 16.7 Million colors/ full frame video
7. Video Input connectors: RGB analog, USB, RCA video, S-VIDEO, VGA

8. Input signal frequency: FU: 31-80kHz; FL: 56-120Hz
9. Video & PC Compatibility: PC, Mac, NTSC, PAL, SECAM HDTV: 480i/480p, 720p, 1080i
10. Image Translucency: Controllable visibility
11. Operational Sound Level: 38 dB
12. Electric Power Voltage: 95-115 or 220-240V VAC
13. Electric Power Frequency: 47-63 Hz
14. Electric Power Consumption: 350W
15. Working Temperature Range: 55F to 95F
16. Working Humidity Range: 25% ± 95%
17. Weight: 15.7kg
18. Dimensions: (W): 28.3 , (D): 15.9 [29.8" expanded], (H): 9.3 (71.8cm x 39.6cm [76cm expanded ] x 36cm)

## VII. REQUIREMENTS

The Heliodisplay requires a power outlet, and a computer, TV, DVD or alternate video source. The current version of the Heliodisplay projects a 22" to 42" (depending on model) diagonal image that floats above the device. The Heliodisplay system is backward compatible and accepts most 2D video sources (PC,TV, DVD, HDTV, Video game consoles). For connection to a computer, the Heliodisplay uses a standard monitor VGA connection; for TV or DVD viewing, it connects using a standard RGB video cable. The Heliodisplay M2 works for regions either in 110V/60Hz, or 220V/50Hz.

The Heliodisplay is interactive, like a virtual touch screen. A hand or finger can act as a mouse. No special glove or pointing device is required. No special glasses are required to view the display. Dark environment is preferred. Just as you use a mouse to move the cursor on a traditional computer monitor, you can use your finger to move the cursor around the Heliodisplay image (see: Images & Videos). The Heliodisplay connects to a computer (at least: Pentium III 400MHZ; 25MB free disk space; Win2000/XP) through a USB port.

## VIII. APPLICATIONS

Applications for this technology are wide-ranging, since the displayed image is non-physical and therefore unobtrusive. Imaged information can be displayed in the center of a room, where people or objects can move through the image, for use in teleconferencing, The system of this invention not only frees up space where a conventional display might be placed, but due to its variable opacity and multi-viewing capability, allows the device to be centered around multiple parties, to freely view, discuss and interact collaboratively with the image and each other. The device can be hung from the ceiling, placed on walls, on the floor, concealed within furniture such as a desk, and project images from all directions, allowing the image can be retracted when not in use. It finds great application in medical field. In an operating theatre, a surgeon can access an imaging databank on his PC using a similar airborne screen or during an open heart surgery the patient’s vital signs would hover above the chest. Thus he need not touch any keys and worry about the hygiene problems.

Some of applications are as follows:

1) Advertising and Promotion, e.g.: trade shows; in-store displays; museum, movie and casino displays; theme parks.
2) Collaborative Decision Making, e.g.: board meetings and presentations; air-traffic control; military command and control; architectural and engineering design; teleconferencing.
3) Simulation & Training e.g.: virtual targets; pre-operative planning; virtual surgery, heads-up display
4) Entertainment e.g.: video games; home theatre
5) Build one into a door jamb and have a walk through image or virtual privacy screen.

## PROPOSED APPLICATIONS FOR THE REAL-WORLD HELIODISPLAY:

### A. *Substitution for class room projectors*

Now a days in every colleges & schools there is need of projector for teaching purpose. Heliodisplay can act as substitute for same. Also we can use heliodisplay for advertising purpose. For eg. if we have any function in college & we want to advertise it currently we are using banners or holdings for same which are not eco-friendly on other hand heliodisplay are eco-friendly.

**SURVEY IN BANGALORE: (Survey area: Kengeri, Jay Nagar, Majestic, Malleshwaram, Yashavntpur )**

**The above areas of banglore are much crowed. These areas having on an average 15 steel holdings of near about 30*30 sizes & 100kg weighs. Therefore total holdings in above areas equal 75 total of 7500kg. If we assume steel prise to be Rs.100/kg then for 7500kg it takes Rs.750000/-. This is only manufacturing cost of holdings. For 30*30 banner it charges Rs.9000/- for single banner single use. Hence for 75 banners it takes Rs.67500/-. Therefore total initial cost will be Rs.817500/- (750000+67500).**

**If we use heliodisplay for same cause the only amount we have to pay is initial cost of Rs.12-13 lac. So we can use 1 mobile heliodisplay per area which is free from pollution & also eco-friendly.**

### B. Virtual forest

Virtual Forest was modified to be used with the Heliodisplay to show how a first person style interfaces would feel, and to show off some advanced real-time rendering techniques on the novel display. A user can navigate the forest by using a tracked wireless joystick to control their velocity and direction (Fig.9). Different buttons also allow the user to look around change the direction of the sunlight.

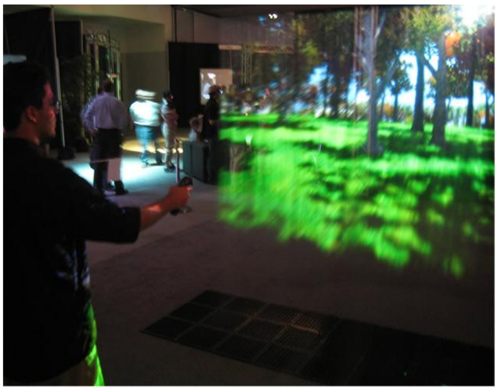

Fig.9 Virtual Forest

### C. Elastic face deformation

This allows the user to interactively stretch and sculpt the shape of a 3D head model. The interface uses a tracked wireless joystick to control a 3D cursor around the head, while buttons on the joystick trigger stretching or sculpting actions (Fig .10). This can be used to find how the face will deform after plastic surgery. This finds great application in criminology.

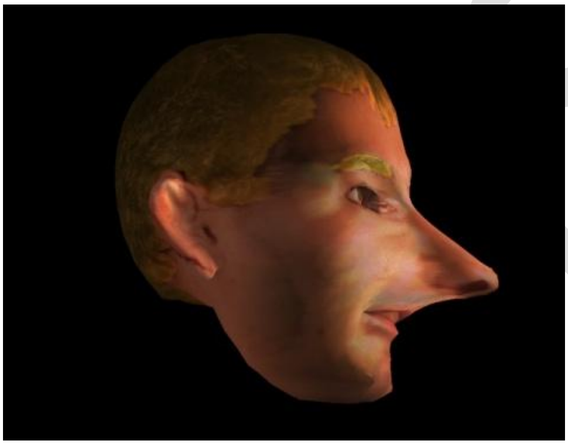

Fig .10 Elastic Face Deformation

## IX. ADVANTAGES & DISADVANTAGES

### A. Advantages

1) The main advantage of heliodisplay is that it needs no screen to project image. It changes the air and creates a dynamic non-solid particle of cloud on to which the image is projected.
2) The device is also light weight and designed to conceal inside furniture. Therefore we can create an effect of displaying images in mid-air. Also nothing is added to the air; nothing affects air quality. Hence it does not cause any health problems.
3) No special glasses or projection screens are required to see the images projected by heliodisplay. Heliodisplay does not create fog. So it does not cause any problems to the other electronic equipments in its vicinity. Projected images and video are two-dimensional, (i.e. planar) but appear 3-D since there is no physical depth reference.
4) Also heliodisplay can project images from all the normal sources like DVD player or PC. It can be used in any country since it works on 220-240VAC. With Heliodisplay, imagery can be seen up to 75 degrees off aspect for a total viewing area of over 150 degrees. Translucency is controllable with the Heliodisplay.

### B. Disadvantages

1) Needs controlled lighting for best working conditions

Darker the ambience the better the clarity of the image projected by heliodisplay. External light sources can seriously affect the visibility of the heliodisplay. The projection screen being transparent other light sources will pass through making the image characterestics hard to distinguish .So heliodisplay units are used only in controlled lighting conditions to ensure greater clarity of viewing.

2) Wind and bright lights interfere with image visibility

Heliodisplay projects images in to a layer of air, acting as an invisible screen in the path of the projector. Since the screen is suspended in mid-air wind around the screen may affect the image projected, a certain amount of waviness is imparted in the displayed image and this is another drawback of heliodislay affecting the visibility of the image. This waviness created is small under less extreme conditions as the projection screen for the image to be projected is sandwiched between two layers of clean air that is continuously flowing out of the base unit. This layers of clean air will give more steadiness to the image.

3) Expensive

Like any other mid-air projection technology heliodisplay is in its developing phase. Various heliodisplay units are made available for common people but it is out of reach of most of the common people as it is expensive. A single heliodisplay unit cost ranges from \$19000 to \$39000.As technology develops further it is likely to get cheaper and same is about to happen to heliodisplay. It is because of this high cost heliodisplay technology is mainly accepted and implemented in various institutions or multinational companies or museums ,casino’s etc where interaction and attraction of clients are very important.

## X. CONCLUSION

The heliodisplay is a relatively new technology and is still being developed. Heliodisplay works as a kind of floating display and touch screen, making it possible to manipulate images projected in air with our fingers. Though it has some flaws the attention that it brings is enormous. Its various applications such as in advertising, a board room etc suggests that its future scope is very large. Several other thin air-displays are available but heliodisplay out classes them and as a result it has more market value. Though it is currently expensive and unaffordable heliodisplay technology has a great potential. It is the future generation display where we can see images projected into mid-air without the help of a solid screen. It could be used for museum or trade-show displays or for advertisements, and would be ideal force collaborative work.

Heliodisplay provides a method and apparatus for generating true high-fidelity full color, high-resolution free-space video or still images with interactive capabilities. The system comprises a self-generating means for creating a dynamic, invisible or near invisible, non-solid particle cloud, by collecting and subsequentially ejecting condensate present in the surrounding air, in a controlled atomized fashion, into a laminar, semi-laminar or turbulent, particle cloud.The interactivity significantly expands the possibilities of the display.

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