OPTICAL CAMOUFLAGE

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DEPT OF IT
OPTICAL CAMOUFLAGE

- Optical camouflage is a hypothetical type of active camouflage currently only in a very primitive stage of development. The idea is relatively straightforward: to create the illusion of invisibility by covering an object with something that projects the scene directly behind that object.
- Optical camouflage is a kind of active camouflage which completely envelopes the wearer. It displays an image of the scene on the side opposite the viewer on it, so that the viewer can "see through" the wearer, rendering the wearer invisible.
- Although optical is a term that technically refers to all forms of light, most proposed forms of optical camouflage would only provide invisibility in the visible portion of the spectrum. Prototype examples and proposed designs of optical camouflage devices range back to the late eighties at least, and the concept began to appear in fiction in the late nineties.
Optical Camouflage
Although *optical* is a term that technically refers to all forms of light, most proposed forms of optical camouflage would only provide invisibility in the visible portion of the spectrum. This technology is currently only in a very primitive stage of development. Creating complete optical camouflage across the visible light spectrum would require a coating or suit covered in tiny cameras and projectors, programmed to gather visual data from a multitude of different angles and project the gathered images outwards in an equally large number of different directions to give the illusion of invisibility from all angles. For a surface subject to bending like a flexible suit, a massive amount of computing power and embedded sensors would be necessary to continuously project the correct images in all directions.
OPERATION

(1) Camera
Capturing the scene behind the person

(2) Computer
Processing the captured image as if you see the real scene

(3) Projector
Projecting the image onto the cloak

(4) Peephole
Seeing from here, you will see as if the cloak is transparent!

(5) Half Mirror
Reflecting the light partly, and let the rest through

(6) Cloak
The image from projector is projected here

The Secret of Transparent Cloak
Components of Optical Camouflage

Combiner

Computer

Micro digital camera

Micro projector

Retro-reflective material
Components

Video Camera
- Capturing the background image requires a video camera, which sits behind the person wearing the cloak. The video from the camera must be in a digital format so it can be sent to a computer for processing.

Computer
- For optical camouflage to work, the hardware/software combo must take the captured image from the video camera, calculate the appropriate perspective to simulate reality and transform the captured image into the image that will be projected onto the retro-reflective material.
The Projector

The modified image produced by the computer must be shone onto the garment, which acts like a movie screen. A projector accomplishes this task by shining a light beam through an opening controlled by a device called an iris diaphragm. An iris diaphragm is made of thin, opaque plates, and turning a ring changes the diameter of the central opening.

Combiner

The system requires a special mirror to both reflect the projected image toward the cloak and to let light rays bouncing off the cloak return to the user's eye. This special mirror is called a beam splitter, or a combiner -- a half-silvered mirror that both reflects light (the silvered half) and transmits light (the transparent half).
Retro-reflective material.

- The cloak that enables optical camouflage to work is made from a special material known as retro-reflective material.

- A retro-reflective material is covered with thousands and thousands of small beads. When light strikes one of these beads, the light rays bounce back exactly in the same direction from which they came.
The Complete System

INVISIBILITY CLOAK System

Combiner

Digital Video Camera

Cloak

Background

Observer

Projector

Computer

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REAL WORLD APPLICATIONS

• Skillfully mixing the real world and the artificial world to make your life and work convenient

• Four markets

Medical    Aviation    Automotive    Home Improvement
Application #1: Medical

- **Surgery**
- *Doctors could use the “invisibility” to see through their hands and tools to make the underlying tissue more “visible.”*
Application #2: Aviation

- Pilots could use optical camouflage to make cockpit floors transparent
- They can see through the cockpit floors to the runway and landing gear
Application #3: Automotive

- A transparent rear hatch or tailgate would make it easy to know when to stop.
DRAWBACKS

• Large amount of external hardware required.

• The illusion is only convincing when viewed from a certain angle.

• The weak point of this technique is that the observer needs to look through a half-mirror. The current system needs a half-mirror and projectors, which were fixed on the ground.