



# iPhone Panoramic Device

## Specifications, Business Plan, and Technical Recommendations

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**Notice:** This document was created specifically for the course « Ingénierie Numérique et Collaborative » at Ecole Centrale Paris and mentions certain imaginary facts and companies for the sake of the course.

### Study Context

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Historically, the activities of the Eurodetect society were focused on high quality industrial detectors, custom designed for specific companies or niche markets (< 100 units). Looking to turn itself into a household name, Eurodetect is investing heavily in research in a new consumer goods division that will be capable of mass producing products on the 100,000 plus scale.

The first system that they are looking into marketing is an automated device for the Apple iPhone that will allow users to take panoramic photos simply and reliably.

Through extensive market research, Eurodetect has discovered that while many panoramic software applications for the iPhone exist, none of them tackle the physical problems inherent in taking quality panoramic photos. Simply put, not even the best software in the world can make up for an inept photographer.



According to Denis Knight, the author of the book [The Absolute Step-by-Step Guide to the Perfect Panorama](#), two of the biggest problems in panoramic photography are caused by taking incompatible photos:

“1. Not enough overlap between frames. If you don't allow enough overlap between frames when shooting, your software may not be able to stitch the frames together properly.

3. Parallax Error. This is a problem where close objects seem to change position between frames because the camera has changed position, due to not being rotated around the 'no parallax point' of the lens (also variously referred to as the entry pupil or nodal point of the lens).” (Source: <http://www.theperfectpanorama.com/> - see Appendix 1 for the full site)

The Eurodetect society is seeking an inexpensive, electro-mechanical system specifically designed for the iPhone that would solve these problems, consistently allowing even the most novice photographer to take quality panoramic images.

## Similar Products

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There is one similar product already out on the market that takes panoramic photos using an external camera:

### “GigaPan Epic” (300 €)



(See Appendix 2 for further product information)

This Gigapan is considerably more complicated and expensive than what Eurodetect expects the iPhone Panoramic Device to be. In addition, it is adaptable to any camera where the society wants a product uniquely designed for the iPhone. However, the Gigapan shows the general idea of how the product might function.

## Functional Requirements

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The iPhone Panoramic Device should:

- Rotate the iPhone about the entry pupil of the iPhone's camera lens.
- Allow full 180 degrees of rotation
- Permit the user to input the start and end points of the photo. There must be a mode that takes a full-view photo.
- Stop at each step after rotating to allow the user to take the photo manually.
- Operate for a minimum of 100 panoramic photographs on a single power supply
- Be able to be placed on uneven ground, such as a rock or sloping roof
- Easily fit in a pocket or purse (i.e. total volume < 300 cm<sup>3</sup>).
- Have a design that is coherent with the design of the iPhone.
- Optionally, manually rotate perpendicular to the plane of photography so the camera can photograph scenes that aren't perfectly horizontal

## Business Plan

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The price of this system should be no more than 30 €. A profit margin of at least 5 € is expected.

Market estimates predict sales of 10,000 units per month immediately after the product launch with the potential for further growth.

The second generation of this product is envisioned to be a completely automatic, integrated system that interfaces with the iPhone software.

## Technical Recommendations

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**Power Supply:** The device should run 1 9V battery.

The casing of the final product will be made by plastic injection. However, it is acceptable for the prototype to be made out of ABS plastic from a 3D printer.

# 6 Top Panorama Problems and How to Solve Them

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**Number 4 in a series of 6 free articles on panorama troubleshooting.**

By Denis Knight, author of [\*The Absolute Step-by-Step Guide to the Perfect Panorama\*](#).

### *Top Panorama Problem #4: Stitching Errors*

Stitching errors are a common problem in panoramic photography, where the photo stitching software made a mistake in lining up the images when it stitched them together. After stitching your panorama you might see some places where objects have been distorted, misaligned or cut in half during the panorama stitching process, like in this example:



*Panorama stitching errors caused by distortion and lack of overlap.*

## The Cause

Here are the six most common causes of stitching errors.

1. Not enough overlap between frames. If you don't allow enough overlap between frames when shooting, your software may not be able to stitch the frames together properly.
2. Distortion. If there's a lot of distortion in the original images, it can make the images much harder for the software to stitch together. Distortion can be caused by a poor quality lens, by using an extra wide angle lens, or by having very close objects in the overlap zone.
3. Parallax Error. This is a problem where close objects seem to change position between frames because the camera has changed position, due to not being rotated around the 'no parallax point' of the lens (also variously referred to as the entry pupil or nodal point of the lens).

4. Lack of visible features. To automatically stitch the frames together, the photo stitching software relies on being able to match up features in each pair of images. If your subject has large areas without many obvious features (like a blank wall or clear blue sky), this can make it hard to stitch.
5. Highly repetitive features. Sometimes, the panorama stitching software can become confused if your images contain a lot of almost identical features repeated throughout the image. An example of this might be an empty football stadium, with row after row of seats forming repetitive patterns across large portions of the image.
6. Bad software. Automatic stitching of images is another area where there are big differences between different software packages. Sadly, some of them just aren't very good at this job.

## The Solution

If you're constantly having trouble with panorama stitching errors, the first thing you must do is to make sure you are allowing plenty of overlap between frames (an overlap of one third is good).

Many cameras have a feature that allows you to overlay the viewfinder with a grid that divides the frame into three parts horizontally and vertically. This makes working out your overlaps easy.

By allowing plenty of overlap, you also reduce problems with distortion. This is because lenses distort the picture more around the very edges of the frame -- especially wide angle lenses.

If your stitching problems are caused by parallax error, you'll need to take more care when shooting to try and rotate your camera around its nodal point.

The best way to do this is using a tripod with a panoramic head attachment. But even an ordinary tripod may help, and if you have to shoot hand-held, make sure you follow the rules for hand-held shooting (stand with your feet apart, hold the camera firmly with two hands, keep the camera horizontal, etc).

Stitching problems caused by a lack of visible features, or by highly repetitive features, can usually be solved by manually adjusting the stitching points. Most panorama software has a feature that allows you to view and adjust the stitch points. If you can master this trick, you'll soon be able to tackle even the most difficult panoramas with ease.

Here's the same panorama with the stitching errors fixed through manual stitching:



*Example panorama fixed by manual stitching.*

Finally, if you've allowed plenty of overlap and your software is still giving you stitching problems, get rid of it! It's hard enough creating great panoramas without putting up with dud software.

In tomorrow's article we'll be exploring another problem that's related to Problem #1, but which shows up in a different way. This is the problem of Color Shifts.

When you read the next article, you'll find out why the stitching process sometimes introduces strange colors into your panoramas, and the two simple steps you can take when shooting, to eliminate this problem completely.

I look forward to joining you again tomorrow.

Kind Regards

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Denis Knight

## Appendix 2



### Products

## The GigaPan EPIC

The revolutionary robotic camera mount.

The GigaPan Epic works with most point and shoot cameras to create multigigapixel panoramas. The GigaPan Epic makes it easy to capture incredibly detailed images and works seamlessly with the [GigaPan Stitcher](#) and [GigaPan.org](#). GigaPan Stitcher Software included with purchase.



### EPIC Imager

\$299.00

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In Stock

[LEARN MORE](#)

The Epic works with most point and shoot digital cameras. [View list of compatible cameras.](#)

3.5 lbs (1.6 kg)  
7.8" x 7.6" x 4.9" (19.8 x 19.3 x 12.4 cm)  
6 AA NiMH Batteries (rechargeables are highly preferred) Note: if using alkaline, a spare set of batteries is recommended.

Camera and batteries not included.

[View Equipment Checklist.](#)

## The EPIC Series

The GigaPan EPIC is a unique robotic camera mount that empowers most small digital cameras with the ability to capture gigapixel images. It is easy to use and remarkably efficient. Simply set the corners of the panorama you want to capture using the LCD interface. The built in software works out how many photos your camera will need to take, hundreds or even thousands. Then the Epic begins snapping the photos, automatically organizing them in overlapping rows and columns.

[View list of tested cameras.](#)

Compact enough to fit into a small camera bag and weighing only 3.5 lbs the Epic is versatile and travels well. You may attach a tripod for stability using the 1/4" tripod mount and level with the onboard bubble level.

[Learn more about using the GigaPan Epic.](#)

### Special Features

- Pause and Scroll Function - Gives you the ability to recapture a specific photo or photos in the sequence.
- Repeatable - You can repeat the last panorama sequence, same photos, same order.
- Exposures - Time between exposures is adjustable.
- Designed for use with compact point-and-shoot, fixed lens digital cameras from all major camera manufacturers.
- 360 degree panoramic range-of-motion
- -60/+90 degree tilt range-of-motion
- Precision incremental movement/resolution of 0.36 degrees
- Simple user-interface consisting of: on/off/ok button, cancel button and four directional buttons.
- Highly visible LCD screen showing easy-to-navigate menu (to set-up panorama, field-of-view, number of rows/columns, etc.)
- Bubble level for quick set-up
- Easy camera mount by self-contained 1/4" industry-standard thumb screw
- Anti-slip camera pad
- Simple camera adjustment for optimal positioning of the focal/nodal point in the fore/aft, up/down and left/right directions, allowing the use of different cameras.
- Easy adjustment of shutter button-activation arm.
- Power Supply Requirements: (6) AA Batteries (Alkaline, Rechargeable NiMH, Lithium, etc.)
- Batteries contained in removable battery pack. A spare pack allows an extra set to be fully charged and ready for use
- Compact, Robust, Durable, Lightweight
- Strong cast-aluminum chassis
- Rigid, powder-coated, stainless steel camera mounting arm minimizes flex and vibration.
- Scale and marking features enable repeatable adjustment

### Equipment Checklist

For SHOOTING with the GigaPan Imager:

- Tripod
- 6 AA Batteries
- Digital Camera with Memory Card (4G)

For STITCHING high resolution images:

- Intel-based Mac or PC with 1 GB of RAM (2 GB recommended)
- Card Reader Stick or USB from camera
- Photo-Stitching software: Link available with purchase