Lab 5

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Submission date: 21-Mar-2017 06:11PM (UTC+0000)
Submission ID: 69094576
File name: EE163_System_Design_Analysis_Lab_5.docx (8.59M)
Word count: 1144
Character count: 5668

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EE163 System Design Analysis Lab 5

Tasks:

A) Product name / part number / manufacturer?

Product name	Part number	Manufacturer
LCD Projector (“conference series”)	XG-V10XE	SHARP

B) Functi 1 f the product?

1.Take an image input and project the image onto a surface.

2.Take an audio input and amplify it and project the sound.

3.Provide a wireless method of changing slides/optical or audio output.

4.Tell the user when there is a fault.

C) How does the product achieve this/these function(s)? 2

Function:	Achieved by:
1	Allowing multiple visual input choices for the user to send the projector data such as S-Video,DVI and VGA inputs allowing the user to switch between them as needed. The amplified image is given by using 2 bright white bulbs to boost the visual output.
2	The projector also has many old style audio L/R inputs for each visual input so the sound for each projected video can be swapped between as needed. These go to 2 8 ohm 3W speakers giving 39dB.
3	There are 2 remote control sensors, one on the back one on the front so that no matter which direction you use the remote from it should get a signal. The remote allows the user to do all projector functions and is the main method of control equal with the one built into the case.
4	There are 4 LED’s on the front of the projector to show when there is a temperature warning, or when each of the 2 bulbs need replacing and finally a power light so that it is known if the projector is getting power.

D) Devise the method(s) by which the product was assembled.

Casing

The plastic casing appears to have been made by injection moulding 7 separate parts(top, bottom,left and right covers, handle,ports cover,filter cover) which have been tightly sealed together using screws with a hinge for the filter cover.

PCB

On all PCB’s in the device there is one side with both SMD and through-hole(top) and one with only SMD(bottom).As components are on both sides a solder bath cannot be used instead the following process as followed which is a type of re-flow soldering:[1]

First of all the blank PCB has solder paste fed onto the bottom pads probably using a stencil to save time and money, either a person or much more likely a machine will place the smd components on this PCB, the entire PCB is then heated attaching the parts through the force of gravity.

Next the process is re-done with the SMD components on the top of the board, as smd component are light and solders surface tension is very high the components on the bottom fall off, if there were any heavy SMD components they would be glued or held in using a solder shield.

The through hole components are then put into the circuit board and another type of stencil (solder shield) is used to hold in the SMD components as the through hole components are wave soldered. The smd components cannot be held in through surface tension in a wave soldering machine as the solder joint is in contact with the solder bath so the surface tension is no longer on the joint.

Other

On the PCB at certain points there can be components found soldered on and wires connecting points to other points(fig 5) as the circuit board has many small holes in it I believe a bed of nails tester is used to test each PCB, and instead of the producers saying that this is faulty the bed of nails tester would say where the issue is and report this to the creator where the PCB can have small adjustments made to save the company the waste it would be to throw away the PCB

Figure 5- an image of a repaired circuit board point

E) Describe the signal inputs and outputs from the product.

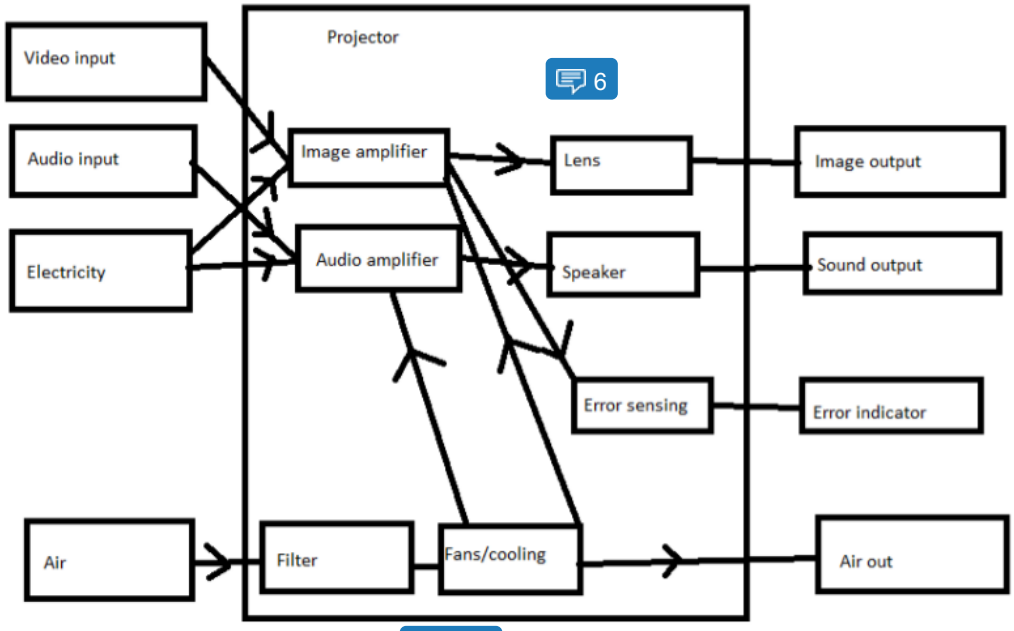
Inputs	Outputs
Image/Video signal(s)	Corresponding projected image
Sound signal	Corresponding amplified sound wave
Infrared control signal	Change functionality of projector
Take internal components measurements	Tell the user when there's an internal error

F) Produce a Parts List for the product.

Due to the pure mass of the product it would take years to make a component list and there were so many sub systems working together only the main ones will be listed in this list:

Plastic injection mould case	Filter	Failure indicator LED's x4	Infrared sensors x2
230V C14 input	Port expansion shield	S-Video input (4 pin mini din) x 3	L/R audio pair inputs x7
DVI input	15-pin Mini D-sub input x2	RS-232C input	RS-232C output
Wired remote input	DC 12V output	BNC input x11	BNC output x3
Mains on/off switch x2	Onboard control buttons x20	8 ohm 3W Speakers x2	Thermal fuses (A100 05N4160 2A01) x2
Screws x Uncountable	Lenses x 18	Dichroic optical coated lens x3	Mirrors x6
Rf shield x2	Heatsinks x Uncountable	LCD screens x3	Fans x 8
Variable lens focus	Motors x3	Unit PSU	Bulb PSU x2
Bulb x2 (for functionality)	Trichroic Prism	7 segment display	Low dropout regulator board (fan driver)
Plastic lens position holder	Video/audio input PCB	Lcd programming PCB x3 (one each for red, and blue)	Speaker driver board
DVI input board	Control board (also the blue lcd board)		

G) Draw a system diagram for the product.



Figures

H) Suggest likely failure mechanisms for the product.

Methods of failure mechanism:

Temperature warning indicator- an indicator is given on the outside of the projector so that when the projector detects a temperature over a threshold the user is told so that they can react as needed.

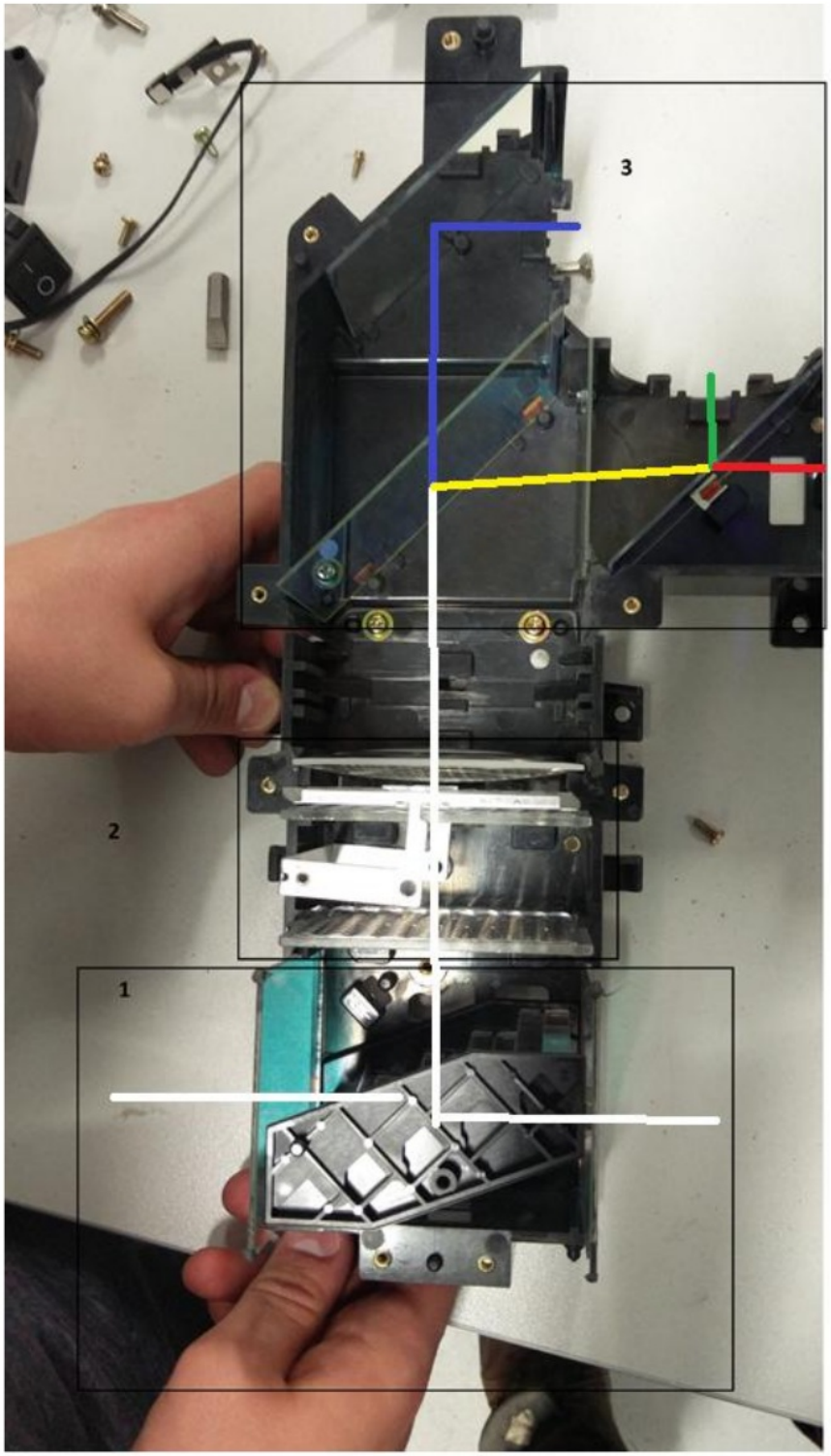
Power indicator- Tells the user if the unit is getting power, this can be used to tell if there is an issue with the psu or if there is an issue with supplying the power so they don't just throw away the entire projector.

Thermal fuse- Stops the projector in case of the unit getting above a threshold temperature to stop the unit becoming unrepairable damaged or starting a fire.

Fuses- on almost every circuit board there was a fuse on the input power so if it receives too much current or voltage it blows so that the entire unit doesn't have to be replaced saving money and time.

I) Provide a description of the packaging and function of an individual electronic/electrical component from the product. Each student should choose a different component.

Light manipulation channel



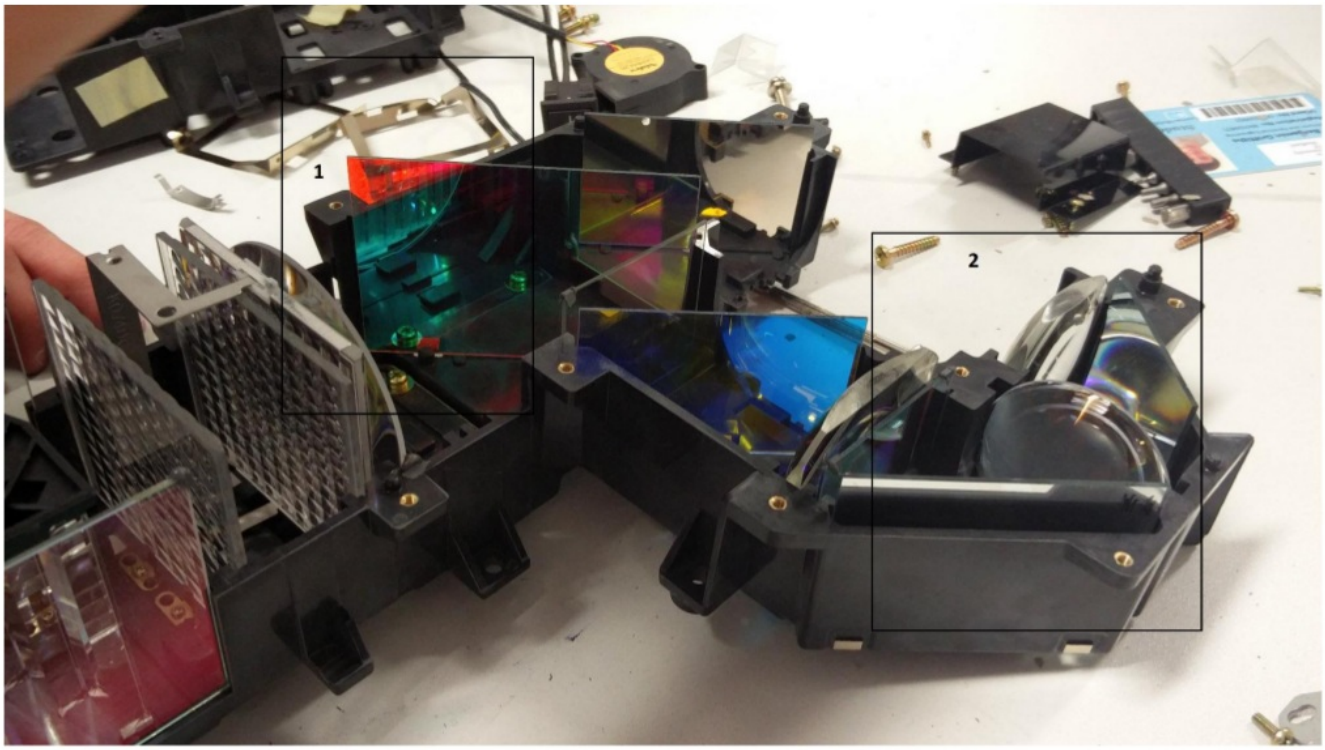
1) Light sources input-
Here the light generated from the left and right bulbs have their light combined into 1 beam. This strange diagonal lens makes it so from both left and right directions have the light projected forwards.
This allows for one bulb to break and the system still works but also for higher brightness output.

2.Light distribution lenses -
These lenses first split up the light into many different seperate beams and then re-cmbining them making the beam output theoretically even throughout

3.RGB colour splitter-
Here the white light enters and hits a dichroic coated glass where blue light passes through and all other wavelengths are reflected the same happens again with the white light with blue light removed so green light is now reflected and red passed through.

7

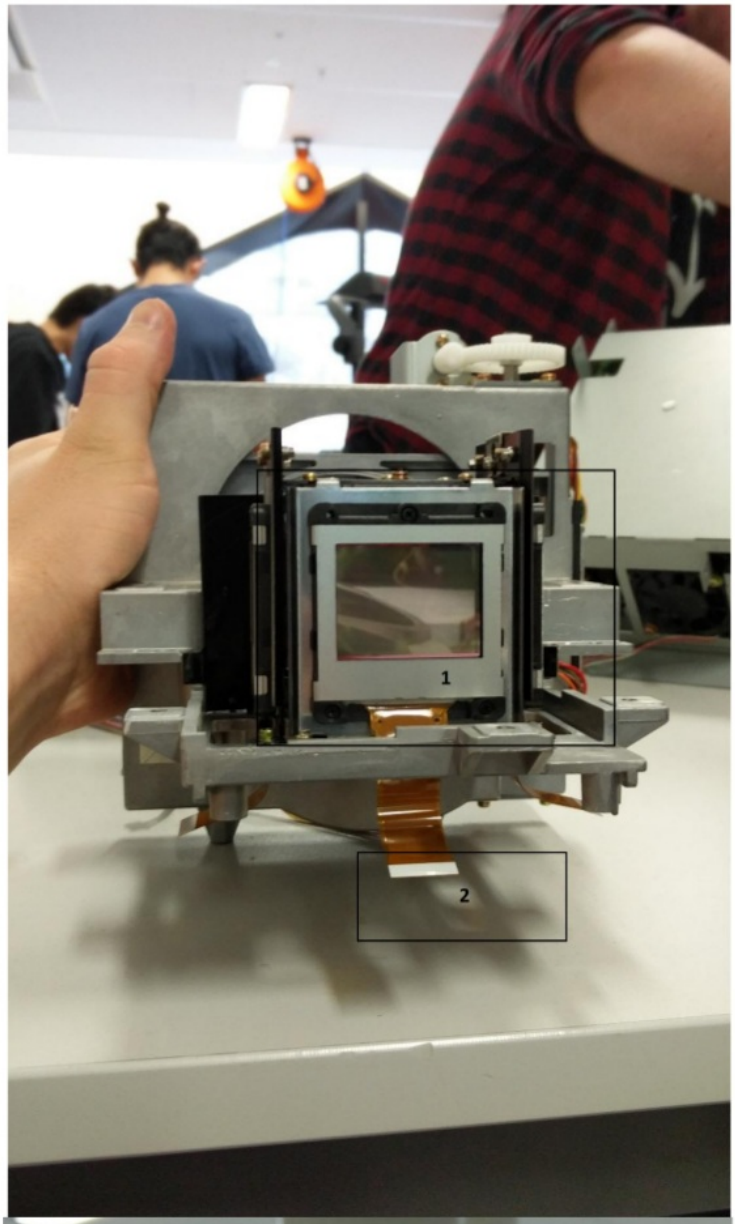
Figure 1-
Light manipulation for projector



1-Dichroic coated lens
You can see in the reflection of this that green and red light is reflected off it and therefore blue light is let through undisturbed.

2-Lens correction
The light that is evenly distributed is given out is designed to be used at a certain distance, this distance is the distance the light travels for the first 2 outputs (blue and green) but for the third the light has to travel further and therefore would be dimmer as it would have more distance to spread out over causing the red light to be much dimmer than the rest givng a bad picture. This manufacture has chosen to correct this by using convex and concave lenses to stop the spreading out which is then fixed again at the output so it works the same as the others so the image is clear and equal.

Figure 2-
Light manipulator



1.An LCD screen
Every pixel in an image can be described by 3 values, the amount of red,green and blue the colour needs to make its actual colour. An image cantherefore be decribed by 3 *pixel count of values. Here for each colour, a pixel is progammed by changing the amount of light that can pass through the lcd screen by turning these pixels on and off and everywhere inbetween. Each of these screens if projected would give the red,green and blue componets of the image respectively. To get what we actually see we need to combine these 3 together. This is done by putting all of these inputs into a trichroic prism which combines all theree colours like an inverse prism. This can be seen in figure 4. It works through the same mechanism as the dichroic lenses to recombine the colours into 1 beam of image.

2.Data input cable
This is where the data for which pixels to block and which to allow is passed into allowing the image to be programmed instead of having a fixed value.

Figure 3-
LCD programable window

Figure 4- Trichroic prism

J) How does your item compare to a modern equivalent (performance, size, cost, power, etc.)?

	Current	Modern
Performance	4,700 ANSI lumens 1280x1024 resolution	2500 ANSI Lumens 1920 x 1080 resolution
Size/Mass	23kg	11kg
Power consumption	575W	355W
Multi-function	Speakers	No speakers
Lifetime	2.000 h bulb	5,000 h bulb
User friendly	Confusing number of ports	Simple port setup
Cost	$16,695	$3,000
Recycling	Generally unrecyclable	Generally unrecyclable

References:

[1]- Author: Anonymous (user3624)

Published: August 11th 2012

Title : Questions on mass-production soldering

Source: Online

Website: Electronics.stackexchange.com

URL: http://electronics.stackexchange.com/questions/37683/questions-on-mass-production-soldering

Lab 5

ORIGINALITY REPORT

9%	1%	0%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of Sheffield Student Paper	8%
2	reviews.cnet.com Internet Source	1%

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		

Lab 5

GRADEMARK REPORT

FINAL GRADE

72/100

GENERAL COMMENTS

Instructor

A ID (/5) 5
B Function (/5) 4
C Operating principles + sketch (/5) 2
D Assembly (/5) 4
E IOs (5) 4
F Parts (/5) 4
G System diagram (/10) 6
H Failure (/5) 3
I Packaging of component (/15) 11
J Modern comparison (/15) 14
Writing (/10) 7
Figures & Tables (/10) 7
References (/5) 1
Total (/100) 72

PAGE 1

Comment 1
digital

Comment 2
You should have explained how the projector works in this section - including how LCDs generate the colour image. Sketch also needed.

PAGE 2

Comment 3
Figure 1

Comment 4
format?

Comment 5
Details of PCB contents needed!

PAGE 3

Comment 6
LCDs missing!

QM

Figures

Figure labels should always appear BELOW the figure.
Figures should also have a TITLE.

PAGE 4

Comment 7

Figure 2

PAGE 5

PAGE 6

Comment 8

LCDs modulate the poalrization of the light. Cross-polarizers before and after the screen must be used to turn the phase modulation into amplitude modulation.

PAGE 7

Comment 9

Nice table!

Comment 10

Hmmm. Q&A site is not a reliable source for references!

Comment 11

Date accessed?