Teacher Resource Bank

GCE Electronics

Sample Coursework

- Sample Two

AQA

Centre-assessed work
Candidate record form
2009

GCE Electronics (2430)
Unit 3 Practical system development (ELEC3)

Centre number

Centre name

Candidate's full name

Candidate number

Notice to candidate The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.

To be completed by the candidate

1. Have you received any help or information from anyone other than your subject teacher(s) in the production of this work?
   Yes ☐ No ☐
2. If you have answered yes, give details below and on a separate sheet if necessary.
3. Any books, leaflets or other materials (eg DVDs, software packages, Internet information) used to help you complete this work and not clearly acknowledged in the work itself must be listed below. Presenting materials copied from books or other sources without acknowledgement will be regarded as deliberate deception.

Candidate declaration I have read and understood the above and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment.

As part of AQA's commitment to assist students, AQA may make your coursework available on a strictly anonymous basis to teachers, examining staff and students in paper form or electronically, through the Internet or other means, for the purpose of indicating a typical mark or for other educational purposes. In the unlikely event that your coursework is made available for the purposes stated above, you may object to this at any time and we will remove the work on reasonable notice. If you have any concerns, please contact AQA.

Date

Teacher declaration I confirm that the candidate's work was conducted under the conditions laid out by the specification. I have authenticated the candidate's work and am satisfied that to the best of my knowledge the work produced is solely that of the candidate.

Date

This form should be attached to the candidate's work and retained at the centre or sent to the moderator as required

ELEC3/CRF

Turn over ▶

Candidate's full name

Candidate number

To be completed by the teacher / assessor and candidate

On each occasion when you and your supervisor discuss your coursework, details of the consultation should be recorded. The record should begin as soon as you start on the coursework, i.e. when the form of the experimental project is being chosen and should be completed when the written report is submitted to your supervisor for assessment.

Date discussion took place	Nature of Discussion (e.g. advice, guidance and help given by the supervising teacher)

I certify that the above is a record of the candidate's work.

Date

Turn over ▶

Candidate's full name

Candidate number

To be completed by the teacher

Marks must be awarded in accordance with the instructions and criteria in the specification. The work **must** be annotated to identify the relevant evidence.

Project title:

Please complete the boxes with the appropriate mark for each criterion.

A Problem analysis and solution design

	mark	comment
a		
b		
c		
d		
e		
f		
g		

B System development

	mark	comment
a		
b		
c		
d		
e		
f		
g		
h		
i		

C Making measurements

	mark	comment
a		
b		
c		
d		
e		
f		

D Report

	mark	comment
a		
b		
c		

Total mark (max 50)

Details of additional assistance given (if any) Record here details of any assistance given to this candidate which is beyond that given to the class as a whole and beyond that described in the specification. Continue on a separate sheet if necessary.

Concluding comments

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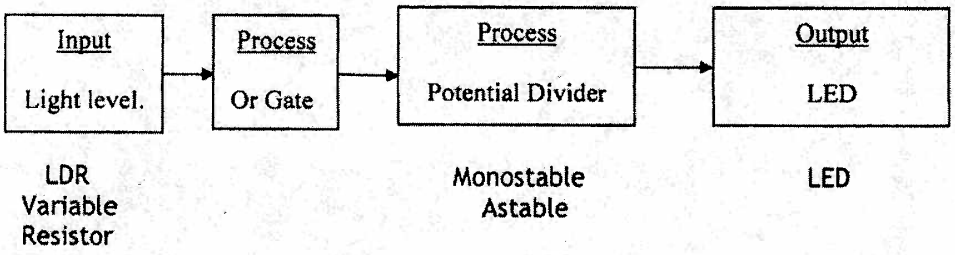
Electronics Coursework

Aa2
Could be worded better to indicate the problem being solved.

The aim of my project is to construct a working model of a motion detector which sets off an alarm or siren when one of two beams of light are broken. This will mean that any "intruder" that passes through the beam of light will set off the siren so that you will know that they are there. This siren will stay on for a set amount of time and then turn off. This device could be placed in a doorway and window as a burglar alarm in a house to alert the owner or nearby people to the presence of an intruder.

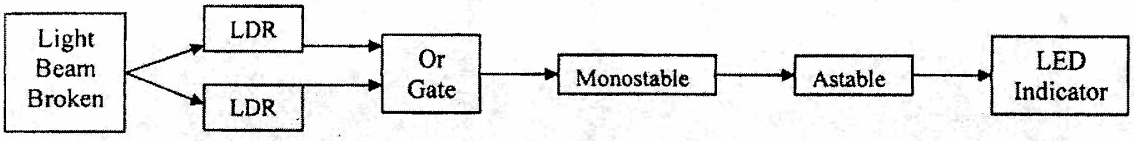
Analysis



The above block diagram displays a concise version of my circuit. The change in light level from one or both of the two LDRs (Light Dependant Resistors) causes a high output to enter the or gate which also has a high output due to the high input, passes through a potential divider coming from the op amp then through monostable and astable chips. If the output is correct, an LED (Light Emitting Diode) indicator will light up, showing that a light beam has been broken.

If the light levels above are at the normal level, the LED indicator will remain off, displaying that neither light has been broken. The use of a monostable and an astable means that the LED indicator will flash on and off for an amount of time that can be set by simply changing the resistors used in the circuit.

Alternative options would have been a heat sensor using a thermistor to detect the heat of an intruder however this would be very inefficient and ineffective. Also I could have used an actually motion detector however this is a lot more complex and unnecessary for what is essentially supposed to be a simple circuit.



The block diagram directly above is a more detailed version of the first. This shows that when a light beam is broken, one LDR will be affected. This

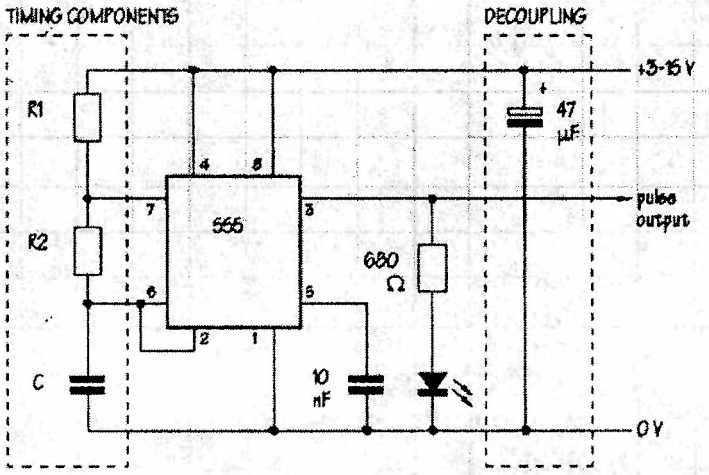
Ad2
Appropriate description at this stage

will change one of the inputs to high on the or gate meaning that the output will change causing a pulse to set off the 555 monostable system.

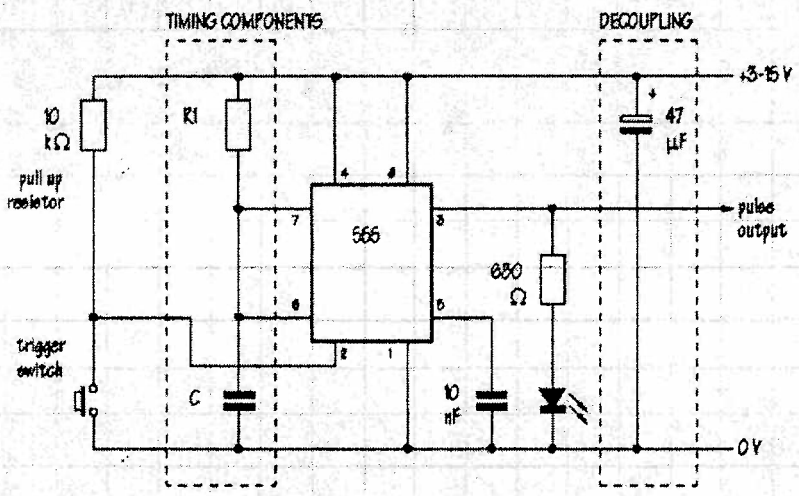
After passing through the monostable and astable chips, which will cause the LED to flash on and off for a set amount of time, the signal does in fact reach the LED indicator and causes it to do as was described. This alerts the user to the fact that the beam has been broken.

Research

I used the internet to find diagrams of monostables, astables and potential dividers, among other things. I also researched certain things so that I could understand them and involve them in my circuits.



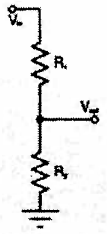
The above is a diagram I found on the website http://www.doctronics.co.uk/555.htm. I used this to put together my astable, so that I knew how to wire it all together correctly. The following diagram came from the same website and is of a monostable. I used this to help me to wire up the monostable correctly so that it was functioning.



Ab2
Two relevant pieces of research.

I also wanted to research potential dividers and so searched for it on the internet. I used the website www.wikipedia.org and found diagrams and formulae which were very useful, as well as text which I used to understand the concept of potential dividers more clearly. Examples of these are:

Two resistors are connected as shown in the following diagram:



The output voltage V_{out} is related to V_{in} as follows:

$$V_{out} = \frac{R_2}{R_1 + R_2} \cdot V_{in}$$

This is the general form that the above equation is derived from

```
Vx=( Rx / Rt )* V
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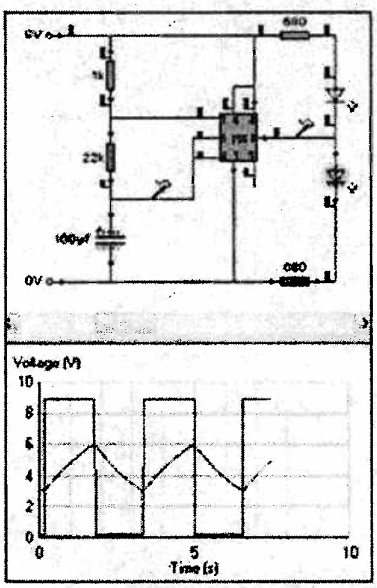
where Rx is the voltage drop you are looking for, Rt is the sum of any number of series resistors, and V is equal to the source voltage

Investigation

For the investigation section of my project I will build a vital subsystem of the whole system and test it to see whether it works. I have chosen to build an astable.

Ac0
Not a practical investigation into system parameters.



The diagram to the left shows how the astable should work. It should affect the voltage so that it pulses on and off, just as I want the LED in my circuit to do.

I created the astable following the diagrams to the left and in the research section, wiring it together as shown. The result was that, when the input is linked to a button and the output to a light, that the circuit works, and when

the button is pressed, the light flashes on and off as expected.

Specification

In this section I will specify the different specifications or criteria that I wish for my system to fulfil.

Power supply voltage: +5 Volts (range +4 - +6 Volts)

Power supply current: 5V maximum when beam not broken,
2V maximum when beam broken.

Battery Life: Will use a DC supply.

Astable: Frequency 1Hz (range +/- 10%)

Monostable: Period 20s (range 18s- 22s)

LED Outputs: Visible from 2m distance.

Ae2
Three appropriate parameters:-
Power supply voltage,
Astable frequency,
Monostable period.

Current - units wrong,
Battery life - not relevant
LED output - not relevant.

Other Possible Designs

Another possible solution for the problem would be to use an op amp comparator instead of an or gate, with all other sections remaining the same. This would mean that if either input changed the output would also change and set off the 555 timers.

I did not choose this option as it would be virtually impossible to have two standard values that are identical to have feeding into the op amp.

Final Design

Ag0
Inadequate justification.

Af0
Inadequate description.

My final design for the project is as specified in the second block diagram in the Analyse section, with the more specific criteria that is mentioned in the Specification included into the equation. I believe that the final design that I have chosen is effective and satisfactory to a standard which completes all of the tasks which I want it to. Therefore I do not feel it needs to be adjusted in any way and that the system I have decided on cannot be improved on in any way that will effect it enough to make it worth the time, effort and cost.

Parts List

3 x Breadboard
Wires
Astable Chip (555)
Monostable Chip (555)
LDR
LED

Or Gate
Variable Resistor
DC Supply
Capacitors (2x100μF, 1x0.01μF, 1x)
Resistors (2 x 7500 ohms, 1 x 100000 ohms)

Calculations

Bb1
Component value not calculated, but values justified instead.

Frequency Of 555 Astable

$$\text{Frequency} = \frac{1.44}{C(r1+2r2)}$$

C=Capacitor
R=Resistor

Resistors both equal 500 ohms
Capacitor = 100×10^{-6} or 0.0001

$$\text{Frequency} = \frac{1.44}{0.0000007 \times 2000000}$$

$0.00000072 \times 2000000 = 1.44$

$\frac{1.44}{1.44} = 1$

Frequency = 1Hz

Power of Circuit

Power = Amps x Volts

Amps of circuit = 27 mA

Volts = 5v

$27 \times 5 = 135$

Power of circuit = 135 mW

Sub System Development

The subsystems in my project are a 555 monostable, 555 astable and an Or Gate.

Diagrams of the 555 timer chips can be seen above.
All calculations carried out are shown above.

Ba1
Inadequate description of any subsystem.

Subsystem 1 - Or Gate

The Or Gate is in my project to produce a high output if either of the two LDRs detect a broken light beam. The high output can then continue through the circuit.
No measurements were taken but this was tested but having two switch inputs and an LED output and the subsystem worked as was expected.
This subsystem is linked to subsystem 2, the 555 monostable, and uses the same voltage rails which means that the high voltages are transferable.

Subsystem 2 and 3 - 555 Timers

The function of these chips is to create a periodic pulse that can act as an alarm. When a high input is fed into these subsystems, the monostable will produce a 20 second pulse and the astable will create a 1 second periodic pulse which means that the output will be 20 1 second pulses.
I took measurements for this section to find out whether the times were reasonably close to the specified ones.
Monostable: Period 20.0189s (Meets Specification)
Astable: Frequency 1.04Hz (Meets Specification)
In the case of interfacing with other subsystems, as in the case with the or gate the rails for high and low voltage are connected and so all voltages remain consistent throughout.

Bc1
Only one measurement per subsystem.

System Details

The system works as follows:

- One or two of the light beams are broken, which is detected by the LDRs.
- The LDRs feed a high input into the or gate, which in turn will do the same to the 555 monostable.
- This sets off the two 555 timer chips creating a 20 seconds periodic alarm showing that a light beam has been broken.

Bd1
Incomplete details of how the system works.

I have calculated the timings of the 555 timers which can be seen above.

Be0
No evidence for layout.

Testing the Final System

To test the system, all that needs to be done is a light beam broken and see whether the alarm will come on for the correct amount of time with the correct timing for each period.
The timing for the periods of the monostable and astable are both above.
All other criteria specified in the specification has een met.

Bg0
No evidence for neatness.

Ca0
No test procedure prior to testing.

Compared to Specification

Power Supply Voltage: + 5 Volts (Meets Specification)

Power supply current: 5 Volts: beam not broken (Meets Specification)
1.6 Volts: beam broken (Meets Specification)

Bh2
System worked.

Battery Life: Uses a DC supply. (Meets Specification)

LED Outputs: Is visible from 2m distance. (Meets Specification)

Bi1
No evidence for 2 marks

Measurements

I took various measurements to ensure certain aspects of my project were contained by the correct boundries.

Ca0
No evidence of planning.

Power supply current: 5 Volts: beam not broken
1.6 Volts: beam broken
Monostable: Period 20.0189s (Meets Specification)
Astable: Frequency 1.04Hz (Meets Specification)

Cb1
Only basic measurements - not complete.

Assessing

Overall the system works as well as could be expected and all boundaries have been kept well within suggesting that the project has been successful and the circuit is a success in itself. All numerical boundaries have had relevant results taken and all were satisfactory.

Cc0
Only basic measurements.

Cd1
Brief assessment made.

System Modifications

In the future, it would be a lot better to modify my system to fit into a casing of some kind so that it would be a lot easier to use and would be more effective. Also, it would be a lot more useful to have a separate 'not gate' from the LJ board, as the necessity for an LJ board to use this system is not cost effective and efficient. As well as this, the size of the LJ board would add another flaw to the system.

Another modification that could be made is that the system is currently limited to just 2 LDRs whereas if a more complex or gate network was used then the amount of light beams could increase which in turn would increase efficiency.

Ce0
No limitations of system as designed identified.

Evaluation

Overall, I am very happy with the system as it performs exactly as it is meant to, and does this while staying in all the boundaries set by the specification. The good thing about the system is that it is never likely to

Cf0
No modifications made.

come into contact with a physical threat as no manual work is needed for it. If it were to be modified to work off of a batteries power, then it would also not be vulnerable to power cuts or the such and so would work over and over again and be very reliable (however it would be hard to know when batteries have run out). Overall, the main flaw with the system is the fact that it is complicated and would be a lot better housed in a box of some kind so it would be easier to install in the home.

The system has met all of the specification targets and so therefore is satisfactory.

Da1
Report matches description of mark.

worked safely

Bf0
No risk assessment only witness statement

Db0
No photograph.
Candidate heavily penalised and could be disqualified!

Dc0
No summary of information or help.