Product

Portfolio summary

This portfolio shows that the student can implement a modular program using an object-oriented programming language. The student uses efficient coding practice principles, calls a function to reduce complexity, defines the function to perform complex mathematical operations and makes effective use of conditional statements.

The student plans tasks to be performed and possible approaches. They explain the motivation for the project and identify key features of the end product. They design modular programs using algorithms and data structures to reflect the relationships of real-world data and data entities. The student evaluates features of technologies and their appropriateness for purpose when producing designed solutions. They consider the end user in the design of the graphical user interface and create a digital prototype of their design.

The student uses Pythagoras' Theorem to find distance between points on the Cartesian plane. They connect similarity and trigonometric ratios and use scale factor to ensure the success of their design. The student uses simple equations and substitution into formulas to adapt GPS data for a phone app. They recognise the boundaries of data that can be used and map these on a plane.

This portfolio has its basis in Technologies with Mathematics playing a significant but secondary role.

App design

Sample summary

This task was part of a unit of work that involved the design of an app for new students to the school. Students were asked to use their knowledge of coordinate geometry and the Cartesian plane to help solve a programming problem associated with development of the app. They were asked to explain how location could be shown on the school map and use diagrams and sections of code to show how they could achieve this in the app. They were also asked to consider the graphical user interface for the landing page of the app.

Achievement Standards

Science

Technologies

Mathematics

By the end of Year 9, students explain chemical processes and natural radioactivity in terms of atoms and energy transfers and describe examples of important chemical reactions. They describe models of energy transfer and apply these to explain phenomena. They explain global features and events in terms of geological processes and timescales. They analyse how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter. They describe social and technological factors that have influenced scientific developments and predict how future applications of science and technology may affect people's lives.

Students design questions that can be investigated using a range of inquiry skills. They design methods that include the control and accurate measurement of variables and systematic collection of data and describe how they considered ethics and safety. They analyse trends in data, identify relationships between variables and reveal inconsistencies in results. They analyse their methods and the quality of their data, and explain specific actions to improve the quality of their evidence. They evaluate others' methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings and ideas to specific audiences.

Report: mapping

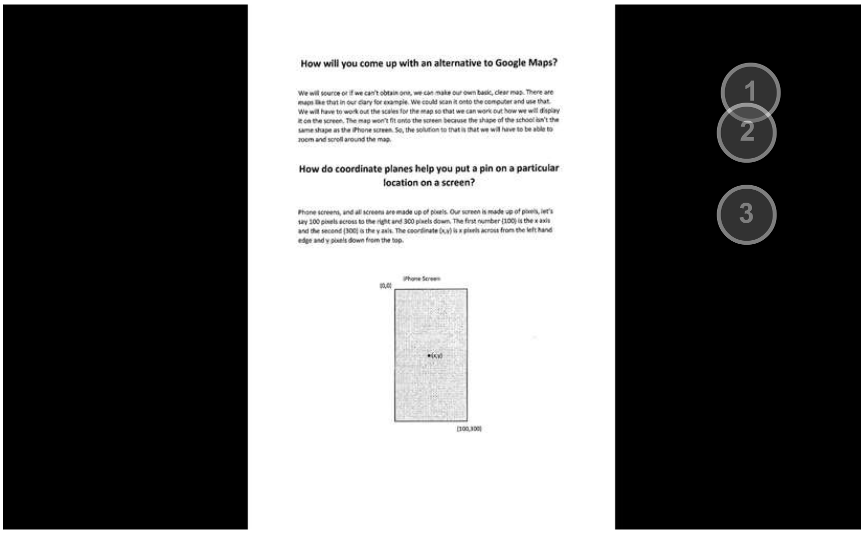
Why can't you just use Google Maps for our Collegiate Map?

You can't just use Google Maps for our Collegiate Map because there isn't enough detail. Also, on Google Maps, it is quite difficult to understand which building is which. It doesn't have the different rooms on it, which is the main element that we need for our map. It doesn't have the building names either. The image is coloured in on Google Maps which isn't very helpful. A black and white drawing with the different rooms marked and labelled, would be much simpler and easier for someone who is unfamiliar with the Senior School to understand.

Our Collegiate School on Google Maps

Annotations

1 Technologies
Explains the motivation for the project



How will you come up with an alternative to Google Maps?

We will source or if we can't obtain one, we can make our own basic, clear map. There are maps like that in our diary for example. We could scan it onto the computer and use that. We will have to work out the scales for the map so that we can work out how we will display it on the screen. The map won't fit onto the screen because the shape of the school isn't the same shape as the iPhone screen. So, the solution to that is that we will have to be able to zoom and scroll around the map.

How do coordinate planes help you put a pin on a particular location on a screen?

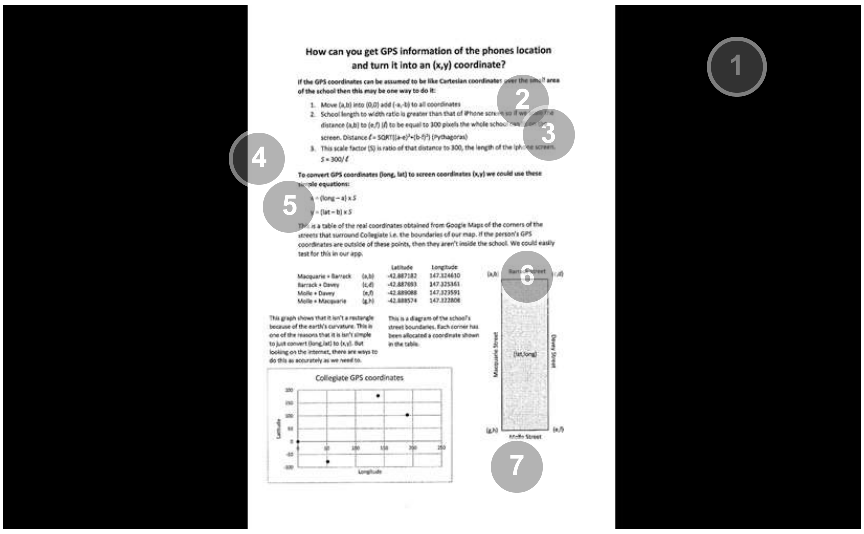
Phone screens, and all screens are made up of pixels. Our screen is made up of pixels, let's say 100 pixels across to the right and 300 pixels down. The first number (100) is the x axis and the second (300) is the y axis. The coordinate (x,y) is x pixels across from the left hand edge and y pixels down from the top.

Annotations

1 Technologies
Envisions individual tasks to be performed, and possible approaches to solutions

2 Technologies
Identifies key features the software will have to provide

3 Technologies
Describes how a device screen is made up of pixels and defines the origin of the pixel coordinate system as the top left corner



How can you get GPS information of the phones location and turn it into an (x,y) coordinate?

If the GPS coordinates can be assumed to be like Cartesian coordinates over the small area of the school then this may be one way to do it:

1. Move (a,b) into (0,0) add (-a,-b) to all coordinates
2. School length to width ratio is greater than that of iPhone screen so if we make the distance (a,b) to (e,f) (ℓ) to be equal to 300 pixels the whole school can fit on the screen. Distance ℓ = SQRT((a-e)²+(b-f)²) (Pythagoras)
3. This scale factor (S) is ratio of that distance to 300, the length of the iphone screen. $S = 300/\ell$

To convert GPS coordinates (long, lat) to screen coordinates (x,y) we could use these simple equations:

x = (long – a) x S

y = (lat – b) x S

This is a table of the real coordinates obtained from Google Maps of the corners of the streets that surround Collegiate i.e. the boundaries of our map. If the person's GPS coordinates are outside of these points, then they aren't inside the school. We could easily test for this in our app.

		Latitude	Longitude
Macquarie + Barrack	(a,b)	-42.887182	147.324610
Barrack + Davey	(c,d)	-42.887693	147.325361
Molle + Davey	(e,f)	-42.889088	147.323591
Molle + Macquarie	(g,h)	-42.888574	147.322808

This graph shows that it isn't a rectangle because of the earth's curvature. This is one of the reasons that it is isn't simple to just convert (long,lat) to (x,y). But looking on the internet, there are ways to do this as accurately as we need to.

This is a diagram of the school's street boundaries. Each corner has been allocated a coordinate shown in the table.

Annotations

1 **Science**
Recognises the assumption being made when GPS coordinates are projected into the Cartesian plane

2 **Mathematics**
Explains how to translate the axes of a Cartesian Plane to make it more usable

3 **Mathematics**
Applies Pythagoras' Theorem to calculate distance

4 **Mathematics**
Applies a scale factor to ensure information will fit to the screen of a phone

5 **Mathematics**
Uses simple equations to make the data usable for the application

6 **Mathematics**
Recognises the boundaries of the data that can be used

7 **Mathematics**
Maps boundaries on a plane

How can you set the pins location to be a set location on the screen?

Pseudo-code

Program: Plot Position

Add image = Collegiate Map

Read current world coordinates from iPhone GPS (long,lat) - This will be an array of two FLOAT elements.

Convert (long,lat) into (x,y) in screen coordinates using above described procedure

Add image = Pin

Make Pin hidden

Pin.center = (x,y) When GPS location is obtained and converted to screen coordinates

How can you make the pin appear?

Pin.hidden = false;

else when GPS location is obtained;

Pin.hidden = true;

How this will all work together to display the persons position on the map?

1. Declare Images
2. Declare Variables
3. Get GPS Location (Long, Lat)
4. Convert to Screen Coordinates (x,y)
5. Set Pin to (x,y)
6. Show Pin

Annotations

1 Technologies Formulates an algorithm using pseudo code

2 Technologies Demonstrates understanding of data types

3 Technologies Uses a conditional statement

4 Technologies Describes the program's main sequence of steps

Coding

mapViewController.swift — 26/06/2015 11:10 am

```
//
//
//  ViewController.swift
//  navbar
//
//  Created by [illegible] 06/2015.
//  Copyright (c) 2015 [illegible] ll rights reserved.
//

import UIKit
import CoreLocation
import Foundation

class mapViewController: UIViewController, CLLocationManagerDelegate {


    @IBOutlet weak var roomLocation: UILabel!
    @IBOutlet weak var destinationPin: UIImageView!

    @IBOutlet weak var pin: UIImageView!

    @IBOutlet weak var textEntered: UITextField!

    var manager:CLLocationManager!

    var screenSizex:CGFloat = 667
    var screenSizey:CGFloat = 375

    var mapLong:CLLocationDegrees = 0.0
    var mapLat:CLLocationDegrees = 0.0


    override func viewDidLoad() {
        super.viewDidLoad()
        manager = CLLocationManager()
        manager.delegate = self
        manager.desiredAccuracy = kCLLocationAccuracyBest
        manager.requestWhenInUseAuthorization()
        manager.startUpdatingLocation()

        // Do any additional setup after loading the view.


    }

    override func touchesBegan(touches: NSSet, withEvent event:UIEvent)
        { self.view.endEditing (true)
        //when the screen is pressed the keyboard is dismissed
    }


    @IBAction func showPin(sender: AnyObject) {
        manager.startUpdatingLocation()

        var convertedx:CGFloat
        var convertedy:CGFloat
        var scaleFactorx:CGFloat = 670
        var scaleFactory:CGFloat = 325
```

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Annotations

1 Technologies Implements a modular program using an object-oriented programming language

2 Technologies Uses comments compliant with best coding practice principles

```
        getScreenSize()

        scaleFactorx = screenSizey/2460
        scaleFactory = screenSizex/1100



        convertedx = converxToScreenPixel(mapLong, lat: mapLat)
        convertedy = converyToScreenPixel(mapLong, lat: mapLat)
        println(convertedx)
        convertedy = convertedy - (300*convertedx/1050)
        //make sure to go passed nav bar
        convertedx = 20 + (convertedx*scaleFactory)
        convertedy = convertedy*scaleFactorx
        //convertedy = 670
        //convertedx = 20

        //not have swapped x and y so correct for landscape screen

        pin.hidden = false
        pin.bringSubviewToFront(pin)

        pin.center = CGPointMake(convertedy, convertedx)

    }

    func converyToScreenPixel(long:CLLocationDegrees, lat:CLLocationDegrees) -
        > CGFloat{


        var rotation:CGFloat = -0.89


        var translatex = (CGFloat(long)+(-147.322675))*1000000

        var translatey = (CGFloat(lat)+(42.888574))*1000000




        var rotate = (-1*translatex * sin(rotation)) + (translatey * cos
            (rotation))



        return rotate

    }

    func converxToScreenPixel(long:CLLocationDegrees, lat:CLLocationDegrees) -
        > CGFloat{
        //workout scale for map
        //delete origin of corner and x times by 100000 to get number large
```

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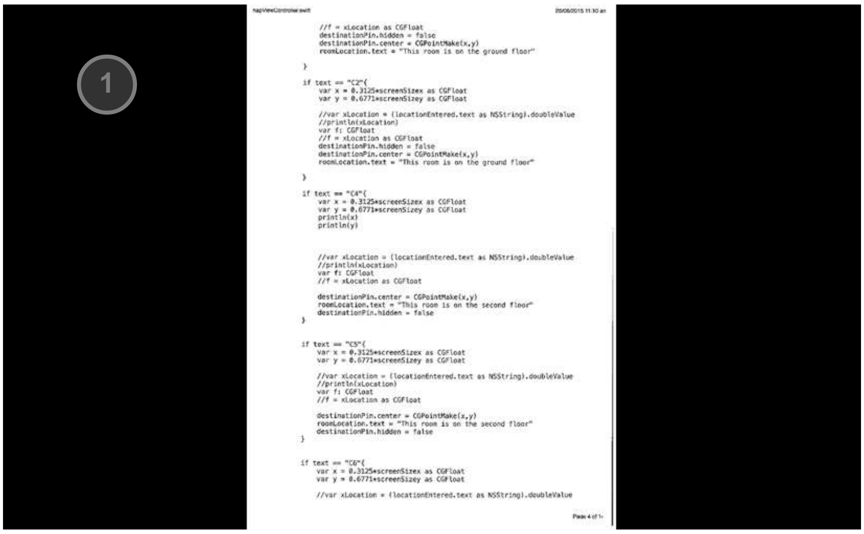
Annotations

1 Technologies Reduces complexity and improves readability of the code by calling a function

2 Technologies Defines a function to perform a complex mathematical operation

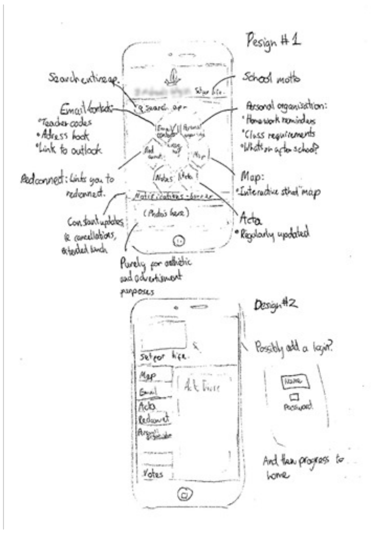


```
        //f = xLocation as CGFloat
        destinationPin.hidden = false
        destinationPin.center = CGPointMake(x,y)
        roomLocation.text = "This room is on the ground floor"

    }

    if text == "C2"{
        var x = 0.3125*screenSizex as CGFloat
        var y = 0.6771*screenSizey as CGFloat

        //var xLocation = (locationEntered.text as NSString).doubleValue
        //println(xLocation)
        var f: CGFloat
        //f = xLocation as CGFloat
        destinationPin.hidden = false
        destinationPin.center = CGPointMake(x,y)
        roomLocation.text = "This room is on the ground floor"

    }

    if text == "C4"{
        var x = 0.3125*screenSizex as CGFloat
        var y = 0.6771*screenSizey as CGFloat
        println(x)
        println(y)


        //var xLocation = (locationEntered.text as NSString).doubleValue
        //println(xLocation)
        var f: CGFloat
        //f = xLocation as CGFloat

        destinationPin.center = CGPointMake(x,y)
        roomLocation.text = "This room is on the second floor"
        destinationPin.hidden = false
    }


    if text == "C5"{
        var x = 0.3125*screenSizex as CGFloat
        var y = 0.6771*screenSizey as CGFloat

        //var xLocation = (locationEntered.text as NSString).doubleValue
        //println(xLocation)
        var f: CGFloat
        //f = xLocation as CGFloat

        destinationPin.center = CGPointMake(x,y)
        roomLocation.text = "This room is on the second floor"
        destinationPin.hidden = false
    }


    if text == "C6"{
        var x = 0.3125*screenSizex as CGFloat
        var y = 0.6771*screenSizey as CGFloat

        //var xLocation = (locationEntered.text as NSString).doubleValue
```

Annotations

1 Technologies
Uses conditional statements to control program flow

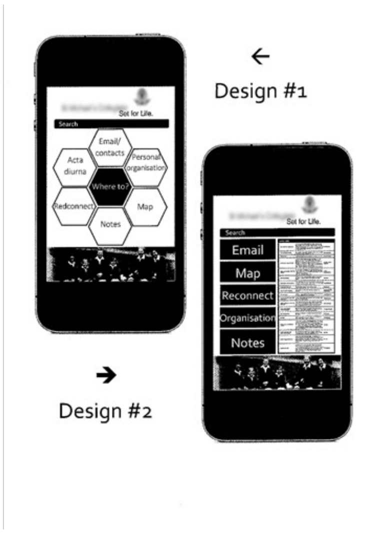
Graphical user interface design



Annotations

1 Technologies
Creates two alternative design drafts for the graphical user interface

2 Technologies
Lists functionality of the main menu points



Annotations

1 Technologies
Creates a digital prototype of the GUI designs