

# Research Document

---

**Student Name:** James Heneghan

**Student ID:** C00155861

**Course ID:** CW\_KCSOF\_B

**Project Name:** Take Me There

**Supervisor:** Joseph Kehoe

**Institute:** Institute of Technology Carlow

**Date:** 16/10/2014

## Contents

Introduction .....	3
Galileo Board.....	3
Details of the Architecture.....	3
Communication.....	3
Accelerometer.....	4
Cloud Hosting.....	4
Google Maps API.....	4
Google Maps JavaScript API.....	4
Google Static Maps API.....	4
Google Maps Embed API.....	4
3G/GPRS Shield .....	5
ADXL Accelerometer .....	5
Example Code .....	5
SQL .....	6
MySQL .....	6
HeidiSQL.....	7
Dementia.....	7
Alzheimer's.....	7
References .....	8

## Introduction

This research document is about the different things that I researched and can include in my Take Me There project. The goal of this project is to develop a wearable device (based on Galileo) that will lead the wearer to a particular location. When activated the device will lead the wearer along the correct path to their destination by signaling when to turn left or right. It will do this by getting directions from Google maps (or similar). It will also upload the wearers current position and route to the cloud. Another feature of this device is letting the carer know if the wearer has left the boundary after curfew by sending a text message to the carer. Also if the wearer falls it will alert the carer to let them know that the wearer has fallen via text message.

## Galileo Board

The Galileo board was developed by Intel. The board was designed for makers, students, electronic enthusiasts, etc. The Intel Galileo board is an extension of the Arduino family but delivers more advanced functionality. The Galileo board uses the same prototyping tools as Arduino but with a few slight changes. It is also compatible with most Arduino shields and it also allows the user to install Linux onto a micro SD card and use Linux commands in the sketches [01].

The Galileo board is based on the Intel Quark SoC X1000 application processor which is a 32 bit Pentium class chip. The Galileo board was designed to be fully compatible with Arduino hardware such as Arduino shields and software to control the board and shields.

The board runs off 3.3v but it can jump to 5v due to the jumper that allows voltage translation at the I/O pins. It also has a few industry standard PC I/O ports that allows the board to be connected via Ethernet, RS 232, and micro USB [02].

## Details of the Architecture

The Galileo board was designed for start out developers board for maker communities, students, etc. The board is also a powerful but cost effective development environment for professional developers. The board features a 400 MHz 32 bit Intel Pentium Instruction Set Architecture with 512KB of embedded SRAM. It also features a built in real time clock. The board also includes a full PCI express slot which works with mini PCIe cards with optional converter plates. Also included are a reboot button to reboot the boards processor and a reset button which resets the sketch and any shields that are attached to the board. A 32GB micro SD card is the max the board can support in terms of storage [02].

## Communication

The Galileo board has a number of ways that it is able to communicate to PC's, Arduino shields and other types of microcontrollers. The board has a UART TTL serial communication. It also has a second UART which has a RS-232 support which is connected by a 3.5mm jack. The USB port allow serial communication over USB which provides a serial connection to other applications on your computer. The USB host port allows the developer to connect peripherals such as mice keyboards and other devices which can be hosted by the board. The mini PCIe slot allows connection of full and half size mini PCI express modules and also gives additional USB host port through the slot. Any standard size mini PCI express cards can be connected to the Galileo board such as WIFI adapters, 3G adapters, Bluetooth adapters, etc.

On the board there is an Ethernet RJ45 connector that allows the Galileo board connect to wired networks. When you are trying to connect the Galileo to a network you must give the board an IP address and a MAC address for it to work. The on board micro SD card reader

can be accessed through the SD library. For the board and the SD card reader to communicate you don't need an SPI interface [02].

## Accelerometer

An accelerometer is a device that measures the acceleration force. The force can be static or dynamic, if the force is static then the force is constant, if the force is dynamic then the force is constantly changing because it is moving.

An accelerometer can be used for measuring the angle that the device is being held at to the earth. If you measure the dynamic acceleration you can determine what way the device is moving.

There are a few different ways in which an accelerometer works. One way they use microscopic crystals that generate voltage when there is accelerative forces and another way is by the sensing a change in the capacitance. This is done by an accelerative force moving one of the microstructures which changes the capacitance and when you add some circuitry to change from capacitance to voltage you get an accelerometer [03].

## Cloud Hosting

Cloud hosting provides a place for people to be able to host their websites. The websites are on a server which allow people to visit the website. The hosts of the websites are companies that lease their servers to individuals or companies for a price to allow them to upload their website for their portfolio, business, etc. Some hosting companies allow people to host one website for free but have restrictions in place for them for example only have a little bit of storage for their websites. Some hosts may also provide an interface for clients to manage their website [04].

## Google Maps API

The Google maps API enables developers ways of placing Google maps into web pages and it allows for simple or extreme customization. There are a few different API's:

- Google Maps JavaScript API
- Google Static Maps API
- Google Maps Embed API [05]

### Google Maps JavaScript API

This version of Google Maps API is designed for people who are familiar to JavaScript [06]. The Google Maps JavaScript API is also used to deliver Google Map images to applications for mobile devices.

### Google Static Maps API

The Google Static Maps API allows you to embed Google maps image into a web page without the need of JavaScript or any other dynamic page loading. The API creates a map based on the URL parameters sent through a HTTP request and returns an image of the map back to the web page [07].

### Google Maps Embed API

The Google Maps Embed API uses a HTTP request to return a dynamic interactive map. The map can be embedded into a web page by setting the API as the src attribute [08].

## 3G/GPRS Shield

The 3G/GPRS shield that I use for the project allows the connectivity to high speed cellular networks. The shield is compatible with arduino, raspberry pi and Intel Galileo boards. Also with this shield you are able to get the GPS coordinates which are in the NMEA(National Marine Electronics Association) standard. The shield uses the NMEA and cellular triangulation to get the GPS coordinates. You can also use this shield to make a phone call and send text messages [09]. A GPS antenna is used to get the satellite signals to be able to receive the NMEA GPS coordinates. Also a 4G antenna is used to be able to send messages to the carer to let them know if the wearer is out of bounds or has fallen over.

## ADXL Accelerometer

The accelerometer used in this project is an ADXL335 accelerometer. This accelerometer has 3 analog outputs, one for the X-axis, one for the Y-axis and one for the Z-axis[10]. This accelerometer is 4mm x 4mm x 1.45mm in size and because its that small it doesn't bulk up the overall design of the project. The accelerometer can withstand up to 10,000g shock before it breaks which is ideal because no one will really fall that hard and break the accelerometer [11].

## Example Code

To see if all the parts for the project were working I used different sample codes to test the parts. For the Galileo board I used the standard Blink test which makes the LED on the Galileo board blink over and over. For setting up your Galileo board all the start up instructions tell you to load the Blink script into the Galileo board to make sure it's working.

```
/*
  Blink
  Turns on an LED on for one second, then off for one second, repeatedly.

  This example code is in the public domain.
  */

// Pin 13 has an LED connected on most Arduino boards.
// give it a name:
int led = 13;

// the setup routine runs once when you press reset:
void setup() {
  // initialize the digital pin as an output.
  pinMode(led, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop() {
  digitalWrite(led, HIGH); // turn the LED on (HIGH is the voltage level)
  delay(1000);             // wait for a second
  digitalWrite(led, LOW);  // turn the LED off by making the voltage LOW
  delay(1000);             // wait for a second
}
```

For the accelerometer I used different example scripts available, put them together to test and see if it was working with the Galileo board.

To test the 3G/GPRS shield I found an Intel document that uses the 3G/GPRS shield with the Galileo board and in the document it had a phone tutorial. I copied the code and uploaded it to the Galileo board and when uploaded I was able to use the serial monitor to put in commands to send a text to my own phone [12].

To test the GPS on the 3G/GPRS shield I changed the phone script a small bit so when I entered in a command it would get the GPS NMEA data. I looked at the cooking-hacks SIM5218 AT command manual to find the right command to get the data I need [13].

## SQL

**S**tructured **Q**uery **L**anguage is the language used to manage data in a relationship database system. SQL consists of data definition language and data manipulation language. Some queries that you can perform on a SQL database are:

- SELECT: which pulls the data from the database.
- INSERT: which puts data into the database.
- UPDATE: which updates a specified column in a specified row.
- DELETE: which deletes a specified data in a specified column.

SQL was initially developed in the 70's at IBM by Donald Chamberlin and Raymond Boyce and was called SEQUEL (**S**tructured **E**nglish **Q**Uery **L**anguage). In the 1970's Relational Software Inc saw the potential of SQL and developed their own. Relational Software Inc released SQL/DB and other products based on their System R commercially between 1979 and 1983.

SQL language is divided into subsection elements:

- Clauses: Which sometimes have statements and queries.
- Expressions: Produces data.
- Predicates: Specifies conditions that can be evaluated.
- Queries: Retrieves specific data
- Statements: Controls program flow [14].

## MySQL

MySQL is the second most popular RDMS and is the most widely used. It does not come with a GUI so I used HeidiSQL as my GUI for my SQL database.

MySQL is an open source RDMS and is mainly used on the command line. There are two versions of MySQL:

1. Community server
2. Enterprise server

MySQL like other SQL databases does not follow the full standards of SQL. MySQL is also limited by hard disk performance.

There are different versions of MySQL such as:

1. MariaDB
2. Drizzle
3. WebScaleSQL
4. etc

MySQL was developed by a Swedish company and MySQL's first release was on 23rd May 1995. It was originally to be used for personal use and was based on mSQL which was based on a low level language and was slow and not very flexible [15].

## HeidiSQL

For MySQL I used HeidiSQL because MySQL does not have GUI interface. HeidiSQL is a free open source client for MySQL. To use The HeidiSQL you must first login to a MySQL server. Once logged in the user is able to manage the MySQL database.

HeidiSQL was created by Ansgar Becker along with a few other programmers. HeidiSQL was originally called SQL-front and in 2006 renamed and re-engineered it HeidiSQL [16].

## Dementia

Dementia is a broad category of brain diseases that makes the person lose the ability to think. Other symptoms include emotional problems, language problems and decrease in motivation. Alzheimer's is the most common type of dementia. Other types of dementia are vascular dementia and lewy body dementia to name a few.

## Alzheimer's

Alzheimer's is a neurodegenerative disease which overtime worsens. The early symptoms of the disease is short term memory loss. As the disease advances, problems with speech, disorientation, mood swings, unable to be able to take care of themselves and behavioral issues. The average life expectancy of a person with Alzheimer's is between 3 and 9 years. There is no treatment to cure or reverse Alzheimer's but treatment may temporarily improve symptoms [17].

Alzheimer's often start in people over the age of 65. There are four stages of Alzheimer's:

- Pre-Dementia
- Early
- Moderate
- Advanced

The cause of Alzheimer's is still unknown except for less than 5% of cases are caused by genetic difference that was identified. There is no evidence to support that any measure is effective against preventing Alzheimer's [18].

## References

- [01] Intel, Intel Galileo Gen 2 Development Board, [www.intel.ie, http://www.intel.ie/content/www/ie/en/do-it-yourself/galileo-maker-quark-board.html](http://www.intel.ie/content/www/ie/en/do-it-yourself/galileo-maker-quark-board.html) [Accessed 14/11/2014]
- [02] Arduino(2014), Intel Galileo, [www.arduino.cc, http://arduino.cc/en/ArduinoCertified/IntelGalileo](http://arduino.cc/en/ArduinoCertified/IntelGalileo) [Accessed 14/11/2014]
- [03] Dimension Engineering LTD, A beginners guide to accelerometers, [http://www.dimensionengineering.com/, http://www.dimensionengineering.com/info/accelerometers](http://www.dimensionengineering.com/) [Accessed 14/11/2014]
- [04] Wiki(Updated Nov 2014), Web hosting service, [www.wikipidea.org, http://en.wikipedia.org/wiki/Web\\_hosting\\_service](http://en.wikipedia.org/wiki/Web_hosting_service), [Accessed 14/11/2014]
- [05] Google Developers(Updated October 2014), FAQ Google Maps API, <https://developers.google.com/maps/faq#whatis>, [Accessed 09/10/2014]
- [06] Google Developers(Updated September 2014), Google Maps Javascript API, developers.google.com, <https://developers.google.com/maps/documentation/javascript/tutorial>, [Accessed 09/10/2014]
- [07] Google Developers(Updated October 2014), Google Static Maps API, developers.google.com, <https://developers.google.com/maps/documentation/staticmaps/>, [Accessed 09/10/2014]
- [08] Google Developers(Updated October 2014), Google Maps Embed API, developers.google.com, <https://developers.google.com/maps/documentation/embed/guide>, [Accessed 09/10/2014]
- [09] Cooking Hacks(Updated August 2012), 3G.GPRS shield for Arduino, <http://www.cooking-hacks.com/3g-gprs-shield-for-arduino-3g-gps>, [Accessed 09/10/2014]
- [10] Adafruit, ADXL335 Accelerometer, <http://www.adafruit.com/products/163>, [Accessed 09/10/2014]
- [11] Adafruit, ADXL335, <http://www.analog.com/en/products/mems/mems-accelerometers/adxl335.html#product-overview>, [Accessed on 22/03/2015]
- [12] Intel(Updated October 2014), Intel® Galileo Board, Intel® Galileo Gen 2 Board, and Intel® Edison Board Shield Testing Report, [http://download.intel.com/support/Galileo-Edison\\_ShieldTestReport\\_330937-002.pdf](http://download.intel.com/support/Galileo-Edison_ShieldTestReport_330937-002.pdf), [Accessed 22/01/2015]
- [13] Cooking-Hacks(Released 13/01/2011), SIM5218\_AT\_command\_manual, [http://www.cooking-hacks.com/skin/frontend/default/cooking/pdf/SIM5218\\_AT\\_command\\_manual.pdf](http://www.cooking-hacks.com/skin/frontend/default/cooking/pdf/SIM5218_AT_command_manual.pdf), [Accessed 4/02/2015]
- [14] Wikipedia(Updated March 2015), SQL, <http://en.wikipedia.org/wiki/SQL>, [Accessed 1/04/2015]



**[15]** Wikipedia(Updated April 2015), MySQL, <http://en.wikipedia.org/wiki/MySQL>, [Accessed 13/04/2015]

**[16]** Wikipedia(Updated March 2015), HeidiSQL, <http://en.wikipedia.org/wiki/HeidiSQL>, [Accessed 13/04/2015]

**[17]** Wikipedia(Updated March 2015), Dementia, <http://en.wikipedia.org/wiki/Dementia>, [Accessed 4/02/2015]

**[17]** Wikipedia(Updated March 2015), Alzheimers disease, [http://en.wikipedia.org/wiki/Alzheimer%27s\\_disease](http://en.wikipedia.org/wiki/Alzheimer%27s_disease), [Accessed 4/02/2015]