***G-sensor with Action Recognition Algorithm***

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# **Week Plan:**

## **The First Week Work:** (18.09.2017 ---24.09.2017)

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| **Time** | **Purpose** | **Task** |
| The first week  (18.09.2017 ---24.09.2017) | **Summary** | Finish:   1. Simply caught some data, and analysed the possibility with this project. 2. Making a direction and plan for the detail I should do in the near future.   Unfinished : |
| The second week  (25.09.2017 ---01.10.2017) | **Plan** | 1. Reading some relative references and keeping those useful materials. 2. Organizing the information from those papers I read and summarizing what you can study from. |

## **The Second Week Work:** (25.09.2017 ---01.10.2017)

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| **Time** | **Purpose** | **Task** |
| The second week  (25.09.2017 ---01.10.2017 | **Summary** | Finish:   1. Reference Read:   ***Name***: Full-Featured Pedometer Design Realized with 3-Axis Digital Accelerometer  ***Link:*** http://www.analog.com/en/analog-dialogue/articles/pedometer-design-3-axis-digital-acceler.html  ***Summary***:  You can see it on the bottom of this paper.  Unfinished : |
| The third week  (02.10.2017 ---08.10.2017) | **Plan** | 1.Reading some relative references and keeping those useful materials.  2.Organizing the information from those papers I read and summarizing what you can study from. |

## **The Sixth Week Work:** (23.10.2017 ---29.10.2017)

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| **Time** | **Purpose** | **Task** |
| The Sixth week  (23.10.2017 ---29.10.2017) | **Plan** | 1.Read relative paper about how to analyse the accelerometer data and record the important points.  2.Organize it and sum up your own point of view. |
|  | **Materials Link** | 1.Read Refefence:  L1: <http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7859881>  L2: https://www.researchgate.net/publication/228547583  L3: https://ac.els-cdn.com/S1877050914008643/1-s2.0-S1877050914008643-main.pdf?\_tid=dd30c5cc-ba7f-11e7-9444-00000aab0f26&acdnat=1509044579\_bba4bc163f3b1c78522d6aadb5912652  L4: <http://www.mdpi.com/1424-8220/10/2/1154/pdf>  L5: <https://www.livescience.com/40103-accelerometer-vs-gyroscope.html>  L6: Step Counting Using Smartphone-Based Accelerometer |

## **The Seventh Week Work:** (30.10.2017 ---05.11.2017)

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| **Time** | **Purpose** | **Task** |
| The Seventh week  (30.10.2017 ---05.11.2017) | **Plan** | 1.Programming for getting the actual number of steps , and has a overall concept of the step algorithm.  Summarizing the approach what kind of algorithms could be used in action identification and how they work. |
|  | **Materials Link** | 1.Read Refefence:  L1:http://meetdevin.cn/2017/03/14/%E8%AE%A1%E6%AD%A5%E7%AE%97%E6%80%BB%E7%BB%93/ |

## **The Eighth Week Work:** (06.11.2017 ---12.11.2017)

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| **Time** | **Purpose** | **Task** |
| The Eighth week  (06.11.2017 ---12.11.2017) | **Plan** | The total purpose:  to show a draft how the program works and explains it literally from collecting data to getting actual numbers of steps.  To let others understand the total process without coding.     1. Considering all the step patterns, such as working, running, and analyzing them with words and diagrams.          2.   Explaining the process in detail by my own words.         3.   Extending some key information, such as important algorithm.         4.   Making a draft and possibly needing to consider about the presentation PowerPoint. |
|  | **Materials Link** | 1. Read Refefence:   The eighth week draft of the step algorithm.docx |

## **The Ninth Week Work:** (11.11.2017 ---17.11.2017)

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| **Time** | **Purpose** | **Task** |
| The Ninth week  (11.11.2017 ---17.11.2017) | **Plan** | The task of this week:   1. I should organize and correct the draft again after you revised and guided it to continously improve my acadamic english ability. 2. I will go on to catch some data and complete the draft to make it more convincing. 3. Of course, I will find some material, like we have already discussed, to find other approaches for steps algrithm. 4. Possibly, Using MFC to create a chain from the acceleration data in excel to show the exact number of steps on the screen. In two week, for the further plan, you should also figure out the gyroscope working principle and use gyroscope to realize some functions. Navigation is a good example for me to figure the gyroscope. |
|  | **Materials Link** | 1. Read Refefence:   The eighth week draft of the step algorithm.docx |

## **The Ninth Week Work:** (11.11.2017 ---17.11.2017)

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| **Time** | **Purpose** | **Task** |
| The Ninth week  (11.11.2017 ---17.11.2017) | **Plan** | The task of this week:   1. Finding a way to catch the raw data from my phone. 2. Finishing the Powerpoint for the next presentation. |
|  | **Materials Link** |  |

# **Materials Records:**

|  |  |
| --- | --- |
| **Period** | **Material** |
| The second week (25.09.2017 ---01.10.2017) | |
| Full-Featured Pedometer Design Realized with 3-Axis Digital Accelerometer | ***Link:*** http://www.analog.com/en/analog-dialogue/articles/pedometer-design-3-axis-digital-acceler.html  ***Summary***:  In a ward, this paper totally tells me how the 3-Axis Digital Accelerometer  (for example ADXL335, ADXL345, and ADXL346) is used to calculate or realize the steps of people walking.  Firstly, you should understand the model:  From the characteristics that can be used to analyse running or walking, we choose three axis acceleration as the relevant parameter. There are three directions acceleration parameter (forward (*roll*), vertical (*yaw*), and side (*pitch*)).  When people start to walk or run , or stop from walking or running, there are different changes in vertical acceleration and forward acceleration. So in this way, we can recognize the current states of people through the changes of acceleration parameters.  Secondly, on one hand, we have to use the data collected from the accelerometer after filtering from a Digital Filter. It means we just can collect the valid data and discard the invalid data.On the other hand, a linear-shift-register and a dynamic threshold are used to decide whether an effective step has been taken.  Thirdly, how to calculate the distance we walked and the power we consumed when we already collect the  number of steps and the distance per step.  *Distance = number of steps* × *distance per step* (1)  *Speed = steps per* 2 s × *stride/*2 s  *Calories* (C/kg/h) = 1.25 × *running speed* (km/h) |
| The Sixth week (23.10.2017 ---29.10.2017) | |
| *A classification of accelerometer data to differentiate pedestrian state* | **Link**: <http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7859881>  ***Summary***:  *Purpose*: In this paper, an alternative way to increase activity recognition performance by using only accelerometer data is purposed. A method to increase activity recognition accuracy by combining filtered data extracted from raw accelerometer data is reported.  *METHODOLOGY:*  *1.* Raw accelerometer data is obtained from a tri-axial accelerometer at rate of 100 Hz.  *2. Total* acceleration is computed from equation:    *3. CLASSIFICATION*  This study presents a model to differentiate pedestrian state focusing on walking up stair, walking down stair, and walking along normal path. A classification result from features extracted from body acceleration provides high accuracy up to 95.07% for training data but the accuracy is drop to 70.70% when applying testing data. |
| *A Step, Stride and Heading Determination for*  *the Pedestrian Navigation System* | **Link**: https://www.researchgate.net/publication/228547583  ***Summary:***  These systems utilized accelerometers and gyros in order to determine step, stride and heading. The performance of the PNS depends on not only the accuracy of the sensors but also the measurement processing methods.  *1. Step detection* |
| *A Study on Human Activity Recognition Using Accelerometer Data from Smartphones* | **Link**: <https://ac.els-cdn.com/S1877050914008643/1-s2.0-S1877050914008643-main.pdf?_tid=dd30c5cc-ba7f-11e7-9444->  ***Summary***:  In this section we describe step-by-step how to discriminate between different activities using the acceleration data collected from a smartphone. First, we need to collect the data. Then we analyze the data to extract informative features. Finally, we use these data for training to build a model based on the selected features and validate it.  *1. Data Collection*    Fast working:    The sampling rate was 100Hz; i.e., one sample for every 10ms.  *2. Feature Evaluation* |
| Machine Learning Methods for Classifying Human Physical  Activity from On-Body Accelerometers | **Link**:http://www.mdpi.com/1424-8220/10/2/1154/pdf  ***Summary***:  *Purpose*: In this paper we exploit an annotated dataset of signals from on-body accelerometers in order to test several classification algorithms, including HMMs with supervised learning.  Methods: (For how to Automatic Classification of Human Physical Activity)   1. Wearable sensors and data acquisitio.   The first important aspect to be considered in building a system for automatic classification of human physical activity concerns the choice of sensors. Wearable sensors should be small and lightweight.   1. Feature evaluation.   Usually, the classification is pursued after that a data representation is built in terms of feature variables.   1. Feature selection and extraction.   The feature selection approach consists of detecting and discarding the features that are demonstrated to minimally help to cause a correct response by the classifier.  4. Taxonomy of classifiers.  A carefully handcrafted setting of thresholds is required in order to separate the various classes under  examination. |
| Accelerometer vs. Gyroscope: What's the Difference? | **Link:** <https://www.livescience.com/40103-accelerometer-vs-gyroscope.html>  ***Summary***:  Uses of a gyroscope or accelerometer  The main difference between the two devices is simple: one can sense rotation, whereas the other cannot. In a way, the accelerometer can gauge the orientation of a stationary item with relation to Earth’s surface. **When accelerating in a particular direction, the accelerometer is unable to distinguish between that and the acceleration provided through Earth’s** **gravitational pull**. If you were to consider this handicap when used in an aircraft, the accelerometer quickly loses much of its appeal.  However, once that platform begins moving, its readings become more complicated to interpret. For example, in a free fall, the accelerometer would show zero acceleration. |
| Step Counting Using Smartphone-Based Accelerometer | **Link:**https://www.google.ie/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwj24bPGoY7XAhUCMSYKHa1dCCoQFggoMAA&url=http%3A%2F%2Fciteseerx.ist.psu.edu%2Fviewdoc%2Fdownload%3Fdoi%3D10.1.1.641.6363%26rep%3Drep1%26type%3Dpdf&usg=AOvVaw1Vbq3cGlbDRWeZcP0s2dz9  ***Summary***:  ***Abstract—***This paper presents a method for counting the number of steps taken by a user, while walking at any variable speed, using smartphone-based accelerometer.  *A. Need for a Step Counting Algorithm*  Counting of steps involves two things: the detection of the ***starting point*** of motion, and the detection ***of each step***. Starting point of motion is detected when standard deviation starts increasing considerably, as compared to the mean standard deviation in the quiet standing phase. This is followed by step detections, for which, a relation has been established between frequency of steps and the magnitude of the accelerometer signal |
| The Seventh week (30.10.2017 ---05.11.2017) | |
| The summary of the step algorithm  (relevant paper: Full-Featured Pedometer Design Realized with 3-Axis Digital Accelerometer) | **Link**:<http://meetdevin.cn/2017/03/14/%E8%AE%A1%E6%AD%A5%E7%AE%97%E6%80%BB%E7%BB%93/>  ***Summary***:  *Purpose*: This paper shows you how to programme the accelerometer data to the actual steps. There are some core algorithm,  1 : , which can help you calculate the overall acceleration of the body movement.  2 : Dynamic Threshold and Dynamic Precision: (Peak value + Bottom Value)/2 is called the dynamic threshold level which is used to decide whether steps have been taken. As it is updated every 50 samples, the threshold is dynamic. This choice is adaptive and fast enough. |