For **FIT**bit **SIM**ulation:

Planning:

1. There should be a list of users with their specific details:-

|  |  |  |  |
| --- | --- | --- | --- |
| Name: String | | --- | --- |
| Age: Int | | --- | Years |
| Home: String | | --- | --- |
| Height: Float | | --- | cm |
| Weight: Double | | --- | pounds |
| Blood Pressure: List(Int, Int) | | --- | mmHg |
| BMI: (SELF FILLED) Double | | Weight / (height)^2 | lbs/cm^2 |
| BodyFat: (SELF FILLED)Double | | **Child Body Fat % = (1.51 x BMI) – (0.70 x Age) – (3.6 x gender) + 1.4**  **Adult Body Fat % = (1.20 x BMI) + (0.23 x Age) – (10.8 x gender) – 5.4**  using gender male= 1, female= 0. | --- |
| deviceID: uuid | | --- | --- |
| userID: uuid (SELF FILLED) | | --- | --- |
| TimeZone: String | | UTC + 5.30 | CONSTANT VALUE |
| Gender: char | --- | | --- |

1. What needs to be sent:-

|  |  |  |
| --- | --- | --- |
| Location: List(Double, Double) | (lat, long) |  |
| HR(heartRate -- pulse) : double | Heartbeats/min – within limit |  |
| Activity: Object (Structure of Summary) | Type of activity – walking, | running, walking, outdoor biking, elliptical, sports, aerobic workout |
| BodyTemp: String | In Celsius | TODO: Know limits |
| Sleep: Object (Structure of Summary) |  |  |
| deviceID : UUID | --- | --- |
| Timestamp : timestamp | --- | --- |
| userID; uuid | --- | --- |
|  |  |  |
|  |  |  |

**Requisites:**

1. First thing we need is a list of users. This list of user will be treated as the source of users: ‘New’ and ‘Existing’. For all users the values will be given or calculated. The range of the values are of the following order:
   * Name 🡪 “User\_0001” to “User\_9999”
   * Age 🡪 68% of the users will be in the age range 25 – 55 (1st quantile)

95% of the user will be in the age range 20 – 70 (2nd quantile)

Mean of the age will be = 40.

Standard deviation = 15

Lower Limit of points needed to plot = 9999

Considering negative interpolation points plotted = 10100 (101 extra points)

* + Home 🡪 Need to obtain information whether we are going to use any “Home” information. Only thing that could be necessary is the “lat” and “long” of a user’s ‘home’ 🡪 So for the time being only that will be considered.
  + Height 🡪 Depending on the height range of Santa Clara, we will assign a random value to each individual.
    1. For **MEN🡪** Average height is 176.2 cm. Range (172.1 cm – 219 cm)
    2. For **WOMEN** 🡪 Average height is 162.9 cm. Range (158.1 cms – 164.8 cm. Exception case = 300.9 cm)
    3. For KIDS 🡪 Used a Mapping.
  + Weight 🡪 Same logic as height.
    1. For **MEN** 🡪 between 170 – 197 pounds
    2. For **WOMEN** 🡪 between 149 – 166 pounds
  + Blood Pressure 🡪

|  |  |  |  |
| --- | --- | --- | --- |
| Normal | 90 - 120 | AND | 60 - 80 |
| Prehypertension | 120 – 139 | OR | 80 – 89 |
| High Blood Pressure(Hypertension) Stage 1 | 140 – 159 | OR | 90 – 99 |
| High Blood Pressure(Hypertension) Stage 2 | 160 - 180 | OR | 100 – 110 |
| Hypertensive Crisis(Emergency care needed) | 180+ (MAX 250) | OR | 110+ (MAX 140) |
| Low | 70 - 90 | AND | 40 – 60 |

* + BMI: Calculated from Height and Weight
  + BodyFat: Calculated from default values
  + Email ID: Will be unique for a specific user.
  + UserID: GENERATED UUID.
  + Gender: M or F. This will be assigned based on a weighted selection depending on the ratios in population 🡪
    1. Male: 50.2%
    2. Female: 49.8%

All of this is to keep the generated data as close to the real data as possible.

Proposed Algorithm:-

Step 1: First plot the age. Since a FItBit will be pretty much user customed.

Step 1.1 : Keep a count of age above 25 🡪 BP Variation will start from that age. Till then normal.

Step 2: Assign a gender to each age based to the weightage.

Step 3: Fill in the height and weight according to the age.

If Age <= 20,

For the respective gender,

Use the Age\_HeightWeight\_Map\_Kids.xlsx file for mapping the values

Else

take a random value of both height and weight from the range already decided.

Step 4: For BP, BMI and BODYFAT:

* 5 categories of users 🡪
  + Very Active (Flag = 5)🡪

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PROB | Low | Normal | PreHyp | Hyp1 | Hyp2 | HypCrisis |
| BP | 7 | 80 | 7 | 4 | 1 | 1 |
| BMI | GENERATED WITH WEIGHT AND HEIGHT | | | | | |
| AGE |  | | | | | |

* + Moderately Active (Flag = 4) 🡪

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PROB | Low | Normal | PreHyp | Hyp1 | Hyp2 | HypCrisis |
| BP | 10 | 65 | 10 | 8 | 6 | 1 |
| BMI | GENERATED WITH WEIGHT AND HEIGHT | | | | | |
| AGE | Waist, neck and Hip Generated according to category | | | | | |

* + Lightly Active (Flag = 3) 🡪

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PROB | Low | Normal | PreHyp | Hyp1 | Hyp2 | HypCrisis |
| BP | 15 | 50 | 12 | 10 | 9 | 4 |
| BMI | GENERATED WITH WEIGHT AND HEIGHT | | | | | |
| AGE | Waist, neck and Hip Generated according to category | | | | | |

* + Sedentary (Flag = 2) 🡪

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PROB | Low | Normal | PreHyp | Hyp1 | Hyp2 | HypCrisis |
| BP | 20 | 40 | 15 | 12 | 10 | 3 |
| BMI | GENERATED WITH WEIGHT AND HEIGHT | | | | | |
| AGE | Waist, neck and Hip Generated according to category | | | | | |

* + No Activity (Flag = 1) 🡪

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PROB | Low | Normal | PreHyp | Hyp1 | Hyp2 | HypCrisis |
| BP | 25 | 20 | 20 | 18 | 10 | 7 |
| BMI | GENERATED WITH WEIGHT AND HEIGHT | | | | | |
| AGE | Waist, neck and Hip Generated according to category | | | | | |

1. ~~To incorporate the possibility of a single person owning multiple FitBit bands, we will make a list of Device IDs – UserID~~
2. Step 5: Each user is instantiated with a UUID of (user ID and Device ID).
3. How to tackle the problem of day and time tracking:-
   * Take current system date
   * Set unix time of current date at 12.00 midnight local time.
   * Let’s assume that an user device sends the data at an interval of 10 seconds simulation world time 🡪
     1. Total number of seconds in a day – 86400
     2. Message time interval for 1 user – 10 secs
     3. Number of messages from an user in a day – 8640
     4. Number of total users proposed – 9999
     5. Total traffic of messages in a day – 86391360
     6. Estimated time taken to send 1 day’s message in REAL WORLD – 14 secs + (APPROXIMATED UPPER LIMIT FOR 1 DAY’S TIME IN SIMULATION WORLD)
   * There will be list of users which will keep a track of all users.
4. Pulse Rate Distribution:
   * bpCategory = LOW

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| userCategory | 5(veryActive) | 4(ModActiv) | 3(LightActiv) | 2(Sedentary) | 1(NoActiv) |
| Below 40% | 2 | 2.2 | 2.4 | 2.6 | 2.8 |
| 50% - 40% | 34 | 37.7 | 41.4 | 45.1 | 48.8 |
| 50% - 85% | 59 | 55 | 51 | 47 | 43 |
| Above 85% | 5 | 5.1 | 5.2 | 5.3 | 5.4 |

* bpCategory = NORMAL

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| userCategory | 5(veryActive) | 4(ModActiv) | 3(LightActiv) | 2(Sedentary) | 1(NoActiv) |
| Below 40% | 1 | 1.2 | 1.4 | 1.6 | 1.8 |
| 50% - 40% | 23 | 25.6 | 28.2 | 30.8 | 33.2 |
| 50% - 85% | 69 | 66 | 63 | 60 | 57 |
| Above 85% | 7 | 7.2 | 7.4 | 7.6 | 8 |

* bpCategory = PRE\_HYP

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| userCategory | 5(veryActive) | 4(ModActiv) | 3(LightActiv) | 2(Sedentary) | 1(NoActiv) |
| Below 40% | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| 50% - 40% | 12.5 | 15.2 | 17.9 | 20.6 | 23.3 |
| 50% - 85% | 79 | 76 | 73 | 70 | 67 |
| Above 85% | 8 | 8.2 | 8.4 | 8.6 | 8.8 |

* bpCategory = HYP\_1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| userCategory | 5(veryActive) | 4(ModActiv) | 3(LightActiv) | 2(Sedentary) | 1(NoActiv) |
| Below 40% | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| 50% - 40% | 0.5 | 3.2 | 5.9 | 8.6 | 11.3 |
| 50% - 85% | 79 | 76 | 73 | 70 | 67 |
| Above 85% | 20 | 20.2 | 20.4 | 20.6 | 20.8 |

* bpCategory = HYP\_2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| userCategory | 5(veryActive) | 4(ModActiv) | 3(LightActiv) | 2(Sedentary) | 1(NoActiv) |
| Below 40% | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| 50% - 40% | 0.5 | 3.2 | 5.9 | 8.6 | 11.3 |
| 50% - 85% | 69 | 66 | 63 | 60 | 57 |
| Above 85% | 30 | 30.2 | 30.4 | 30.6 | 30.8 |

* bpCategory = HYP\_CR

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| userCategory | 5(veryActive) | 4(ModActiv) | 3(LightActiv) | 2(Sedentary) | 1(NoActiv) |
| Below 40% | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| 50% - 40% | 0.5 | 3.2 | 5.9 | 8.6 | 11.3 |
| 50% - 85% | 59 | 55 | 51 | 47 | 43 |
| Above 85% | 40 | 41.2 | 42.4 | 43.6 | 44.8 |