University of British Columbia, Vancouver

Department of Computer Science

CPSC 304 Project Cover Page

Milestone #: 2

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Group Number: 71

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By typing our names and student numbers in the above table, we certify that the work in the attached assignment was performed solely by those whose names and student IDs are included above. (In the case of Project Milestone 0, the main purpose of this page is for you to let us know your e-mail address, and then let us assign you to a TA for your project supervisor.)

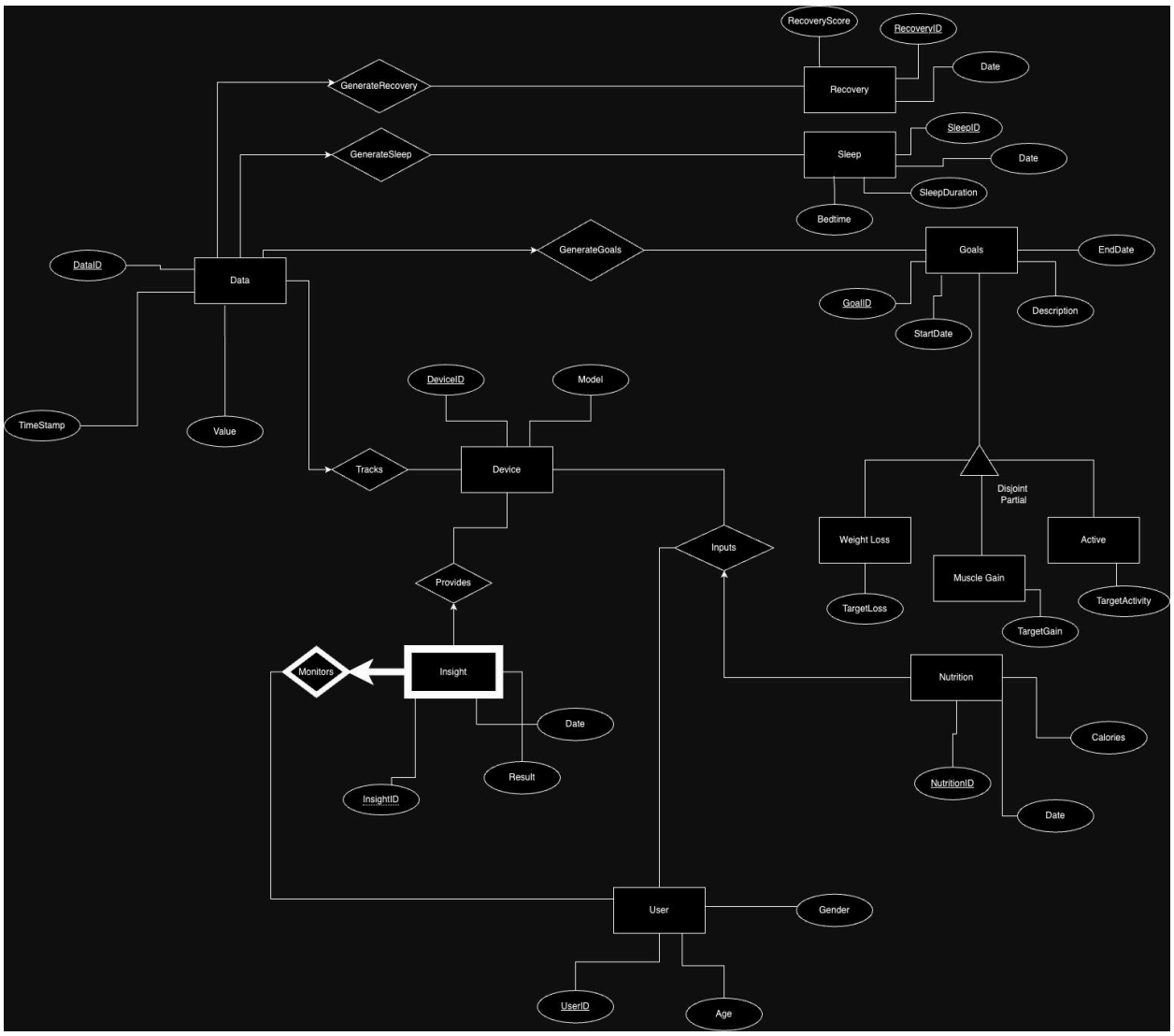
In addition, we indicate that we are fully aware of the rules and consequences of plagiarism, as set forth by the Department of Computer Science and the University of British Columbia

Milestone 2

2. Project Description:

The project represents data being collected by a wearable device that provides qualitative and quantitative insights and recommendations to the user. The statistical data will include aspects such as personal goals, sleep patterns, and recovery metrics, then it will provide insights based on collected data to enhance the user experience. Not to mention, data propagated by the user about nutrition can be analyzed by the device and included in the insights provided.

3. ER Diagram:



- Changed “Quality” attribute in Sleep to “Bedtime”
- Changed “TargetActive” attribute in Active to “TargetActivity”

4. Relational Schema:

GenerateSleepData(<u>DataID</u>: INTEGER, Timestamp: DATE, Value: INTEGER, **SleepID**: INTEGER)

GenerateRecoveryData(<u>DataID</u>: INTEGER, Timestamp: DATE, Value: INTEGER, **RecoveryID**: INTEGER)

GenerateGoalsData(<u>DataID</u>: INTEGER, Timestamp: DATE, Value: INTEGER, **GoalID**: INTEGER)

TracksData(<u>DataID</u>: INTEGER, Timestamp: DATE, Value: INTEGER, **DeviceID**: INTEGER)

Sleep(<u>SleepID</u>: INTEGER, Date: DATE, Duration: INTEGER, Bedtime: INTEGER) with “Date” unique

Recovery(<u>RecoveryID</u>: INTEGER, RecoveryScore: INTEGER, Date: DATE) with “Date” unique

Goals(<u>GoalsID</u>: INTEGER, Start_Date: DATE, End_Date: DATE, Description: Char(50))

WeightLoss(<u>**GoalsID**</u>: INTEGER, TargetLoss: INTEGER)

MuscleGain(<u>**GoalsID**</u>: INTEGER, TargetGain: INTEGER)

Active(<u>**GoalsID**</u>: INTEGER, TargetActivity: CHAR(20))

NutritionInputs(<u>NutritionID</u>: INTEGER, **DeviceID**: INTEGER, **UserID**: INTEGER, Calories: INTEGER, Date: DATE)

Device(<u>DeviceID</u>: INTEGER, Model: CHAR(20))

User(<u>UserID</u>: INTEGER, Age: INTEGER, Gender: CHAR(1))

InsightMonitors(<u>InsightID</u>: INTEGER, Result: Char(50), Date: DATE, <u>**UserID**</u>: INTEGER)

InsightProvides(<u>InsightID</u>: INTEGER, Result: Char(50), Date: DATE, **DeviceID**: INTEGER)

5. FDs:

- GenerateSleepData(<u>DataID</u>: INTEGER, Timestamp: DATE, Value: INTEGER, **SleepID**: INTEGER)

  DataID -> Value, Timestamp
  DataID -> SleepID
  Timestamp -> Value
  CKs: {DataID}

- Sleep(<u>SleepID</u>: INTEGER, Date: DATE, Duration: INTEGER, Bedtime: INTEGER)

  SleepID -> Date, Duration, Bedtime
  Date -> SleepID, Duration, Bedtime
  Duration -> Bedtime
  CKs: {SleepID}, {Date}

- GenerateRecoveryData(<u>DataID</u>: INTEGER, Timestamp: DATE, Value: INTEGER, **RecoveryID**: INTEGER)

  DataID -> Value, Timestamp
  DataID -> RecoveryID
  Timestamp -> Value
  CKs: {DataID}

- Recovery(<u>RecoveryID</u>: INTEGER, RecoveryScore: INTEGER, Date: DATE)

  RecoveryID -> RecoveryScore, Date
  Date -> RecoveryScore, RecoveryID
  CKs: {RecoveryID}, {Date}

- GenerateGoalsData(<u>DataID</u>: INTEGER, Timestamp: DATE, Value: INTEGER, **GoalID**: INTEGER)

  DataID -> Value, Timestamp
  DataID -> GoalID
  Timestamp -> Value
  CKs: {DataID}

- Goals(<u>GoalsID</u>: INTEGER, StartDate: DATE, EndDate: DATE, Description: VARCHAR)

  GoalsID -> StartDate, EndDate, Description
  CKs: {GoalsID}

- WeightLoss(**<u>GoalsID</u>**: INTEGER, TargetLoss: INTEGER)

  GoalsID -> TargetLoss
  CKs: {GoalsID}

- MuscleGain(**<u>GoalsID</u>**: INTEGER, TargetGain: INTEGER)

  GoalsID -> TargetGain
  CKs: {GoalsID}

- Active(**<u>GoalsID</u>**: INTEGER, TargetActivity: CHAR(20))

  GoalsID -> TargetActivity
  CKs: {GoalsID}

- NutritionInputs(<u>NutritionID</u>: INTEGER, **DeviceID**: INTEGER, **UserID**: INTEGER, Calories: INTEGER, Date: DATE)

  NutritionID -> DeviceID, UserID, Calories, Date
  CKs: {NutritionID}

- Device(<u>DeviceID</u>: INTEGER, Model: CHAR(20))

  DeviceID -> Model
  CKs: {DeviceID}

- TracksData(<u>DataID</u>: INTEGER, Timestamp: DATE, Value: INTEGER, **DeviceID**: INTEGER)

  DataID -> Timestamp, Value, DeviceID
  Timestamp -> Value
  CKs: {DataID}

- User(<u>UserID</u>: INTEGER, Age: INTEGER, Gender: CHAR(1))

  UserID -> Age, Gender
  CKs: {UserID}

- InsightMonitors(<u>InsightID</u>: INTEGER, Result: VARCHAR, Date: DATE, **<u>UserID</u>**: INTEGER)

  InsightID, UserID -> Result, Date
  CKs: {InsightID, UserID}

- InsightProvides(<u>InsightID</u>: INTEGER, Result: Char(50), Date: DATE, **DeviceID**: INTEGER) with “Date” unique
  - InsightID -> DeviceID, Result, Date
  - CKs: {InsightID}

6. Normalization

GenerateSleepData(<u>DataID</u>: INTEGER, Timestamp: DATE, Value: INTEGER, **SleepID**: INTEGER)

A B C D

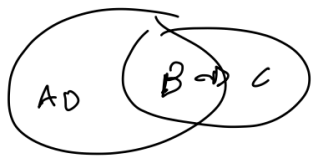
$A \to BC$

$A \to D$

$B \to C$

$A^+ \{ABCD\}$

$B^+ \{BC\}$



$R_2(\underline{A}BD)$ $R_1(\underline{B}C)$

FK

$\Rightarrow R_1(\underline{DataID}, TimeStamp, SleepID)$

$R_2(\underline{TimeStamp}, Value)$

- Sleep(<u>SleepID</u>: INTEGER, Date: DATE, Duration: INTEGER, Bedtime)

A B C D

$A \to BCD$

$B \to ACD$

$C \to D$

decompose on $C \to D$

$\Rightarrow R_1(\underline{Duration}, BedTime)$

$R_2(\underline{SleepID}, \underline{Date}, Duration)$

$R_1(\underline{A}\underline{B}C)$ $R_2(\underline{C}D)$

GenerateRecoveryData(<u>DataID</u>: INTEGER, Timestamp: DATE, Value: INTEGER, **RecoveryID**: INTEGER)

A B C D

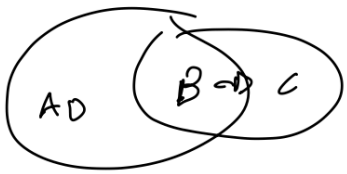
$A \rightarrow BC$

$A \rightarrow D$

$B \rightarrow C$

$A^+ \{ABCD\}$

$B^+ \{BC\}$



$R_2(\underline{A}BD)$ $R_1(\underline{B}C)$

$\Rightarrow R_1(\underline{DataID}, TimeStamp, RecoveryID)$ ↳ FK

$R_2(\underline{TimeStamp}, Value)$

GenerateGoalsData(<u>DataID</u>: INTEGER, Timestamp: DATE, Value: INTEGER, **GoalID**: INTEGER)

A B C D

DataID -> Value, Timestamp
DataID -> GoalID
Timestamp -> Value
CKs: {DataID}

$A \rightarrow BC$

$A \rightarrow D$

$B \rightarrow C$

$A^+ \{ABCD\}$

$B^+ \{BC\}$

$R_2(\underline{A}BD)$ $R_1(\underline{B}C)$

$\Rightarrow R_1(\underline{DataID}, TimeStamp, GoalID)$ ↳ FK

$R_2(\underline{TimeStamp}, Value)$

Goals(<u>GoalsID</u>: INTEGER, StartDate: DATE, EndDate: DATE, Description: VARCHAR)

GoalsID -> StartDate, EndDate, Description
CKs: {GoalsID}

Already in BCNF

WeightLoss(**<u>GoalsID</u>**: INTEGER, TargetLoss: INTEGER)

GoalsID -> TargetLoss
CKs: {GoalsID}

Already in BCNF

MuscleGain(**<u>GoalsID</u>**: INTEGER, TargetGain: INTEGER)

GoalsID -> TargetGain
CKs: {GoalsID}

Already in BCNF

9 Active (*Goals ID*, TargetActivity)

Define A = GoalsID B = TargetActivity
FDs:
A → B

This is in BCNF since A is the only superkey

10 NutritionInputs(NutritionID, *DeviceID*, *UserID*, Calories, Date)

Define A = NutritionID B = DeviceID ; C = UserID. D = Calories
E = Date.
FDs
A → BCDE

This is in BCNF since A is the only superkey

11 Device (DeviceID, Model)
FDs
DeviceID → Model

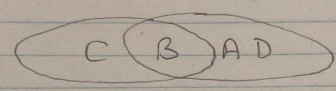
This is in BCNF since Device is the only superkey

12 Tracks Data (DataID, Timestamp, Value, *DeviceID*)

Define A = DataID, B = Time stamp, C = Value, D = DeviceID
FDs:
A → BCD
B → C
Not In BCNF since B is not a Super Key

TracksData(A, B, C, D)

B → C violates BCNF, Decompose



R_1 (CB, C) R_2 (ABD)

Both relations are now in BCNF.

13 User (User ID, Age, Gender)

FDs

User ID → Age, Gender

This is in BCNF since UserID is the only Superkey.

14 InsightMonitors (InsightID, Result, Date, *User ID*)

FD

Insight ID, User ID → Result, Date

This is in BCNF since {InsightID, UserID} is the only SuperKey

15 InsightProvides (InsightID, Result, Date, *Device ID*)

FDs

Insight ID → Device ID, Result, Date

This is in BCNF since Insight ID is the only SuperKey.

7. SQL DDL Statements

```
CREATE TABLE User (
   UserID INTEGER PRIMARY KEY,
   Age INTEGER,
   Gender CHAR(1)
)

CREATE TABLE Device (
   DeviceID INTEGER PRIMARY KEY,
   Model CHAR(20)
)

CREATE TABLE Sleep (
   SleepID INTEGER PRIMARY KEY,
   Date DATE UNIQUE,
   Duration INTEGER,
   Bedtime INTEGER
)

CREATE TABLE Recovery (
   RecoveryID INTEGER PRIMARY KEY,
   RecoveryScore INTEGER,
   Date DATE UNIQUE
)

CREATE TABLE Goals (
   GoalsID INTEGER PRIMARY KEY,
   Start_Date DATE,
   End_Date DATE,
   Description VARCHAR
)

CREATE TABLE WeightLoss (
   GoalsID INTEGER PRIMARY KEY,
   TargetLoss INTEGER,
   FOREIGN KEY (GoalsID) REFERENCES Goals(GoalsID)
)

CREATE TABLE MuscleGain (
   GoalsID INTEGER PRIMARY KEY,
   TargetGain INTEGER,
   FOREIGN KEY (GoalsID) REFERENCES Goals(GoalsID)
)
```

```
CREATE TABLE Active (
   GoalsID INTEGER PRIMARY KEY,
   TargetActivity CHAR(20),
   FOREIGN KEY (GoalsID) REFERENCES Goals(GoalsID)
)

CREATE TABLE NutritionInputs (
   NutritionID INTEGER PRIMARY KEY,
   DeviceID INTEGER,
   UserID INTEGER,
   Calories INTEGER,
   Date DATE,
   FOREIGN KEY (DeviceID) REFERENCES Device(DeviceID),
   FOREIGN KEY (UserID) REFERENCES User(UserID)
)

CREATE TABLE GenerateRecoveryData (
   DataID INTEGER PRIMARY KEY,
   Timestamp DATE,
   Value INTEGER,
   RecoveryID INTEGER,
   FOREIGN KEY (RecoveryID) REFERENCES Recovery(RecoveryID),
         ON DELETE SET NULL
         ON UPDATE CASCADE
)

CREATE TABLE GenerateGoalsData (
   DataID INTEGER PRIMARY KEY,
   Timestamp DATE,
   Value INTEGER,
   GoalID INTEGER,
   DeviceID INTEGER,
   FOREIGN KEY (GoalID) REFERENCES Goals(GoalsID),
         ON DELETE SET NULL
         ON UPDATE CASCADE
  )
```

```
CREATE TABLE GenerateSleepData (
   DataID INTEGER PRIMARY KEY,
   Timestamp DATE,
   Value INTEGER,
   SleepID INTEGER,
   FOREIGN KEY (SleepID) REFERENCES Sleep(SleepID),
         ON DELETE SET NULL
         ON UPDATE CASCADE
   )

CREATE TABLE TracksData (
   DataID INTEGER PRIMARY KEY,
   Timestamp DATE,
   Value INTEGER,
   DeviceID INTEGER,
   FOREIGN KEY (DeviceID) REFERENCES Device(DeviceID),
         ON DELETE SET NULL
         ON UPDATE CASCADE
)

CREATE TABLE InsightMonitors (
   InsightID INTEGER,
   Result VARCHAR,
   Date DATE,
   UserID INTEGER,
   PRIMARY KEY (InsightID, UserID),
   FOREIGN KEY (UserID) REFERENCES User(UserID),
         ON DELETE CASCADE
)

CREATE TABLE InsightProvides (
   InsightID INTEGER PRIMARY KEY,
   Result VARCHAR,
   Date DATE,
   DeviceID INTEGER,
   FOREIGN KEY (DeviceID) REFERENCES Device(DeviceID)
         ON DELETE SET NULL
         ON UPDATE CASCADE
)
```

8. Insert Statements

```
INSERT INTO User (UserID, Age, Gender) VALUES
(1, 25, 'M'),
(2, 30, 'F'),
(3, 40, 'M'),
(4, 35, 'F'),
(5, 28, 'M');

INSERT INTO Device (DeviceID, Model) VALUES
(1, 'MyFitTrackerV2'),
(2, 'MyFitTrackerV2'),
(3, 'MyFitTrackerV2Pro'),
(4, 'MyFitTrackerV1'),
(5, 'MyFitTrackerV4');

INSERT INTO Sleep (SleepID, Date, Duration, Bedtime) VALUES
(1, '2024-02-01', 420, 23),
(2, '2024-02-02', 390, 9),
(3, '2024-02-03', 450, 22),
(4, '2024-02-04', 480, 11),
(5, '2024-02-05', 400, 10);

INSERT INTO Recovery (RecoveryID, RecoveryScore, Date) VALUES
(1, 80, '2024-02-01'),
(2, 75, '2024-02-02'),
(3, 85, '2024-02-03'),
(4, 90, '2024-02-04'),
(5, 82, '2024-02-05');

INSERT INTO Goals (GoalsID, Start_Date, End_Date, Description) VALUES
(1, '2024-01-01', '2024-06-30', 'Lose weight'),
(2, '2024-01-15', '2024-07-15', 'Gain muscle'),
(3, '2024-02-01', '2024-04-30', 'Increase recovery time’),
(4, '2024-03-01', '2024-09-30', 'Eat healthier'),
(5, '2024-02-15', '2024-08-15', 'Stick to a bedtime');

INSERT INTO WeightLoss (GoalsID, TargetLoss) VALUES
(1, 10),
(4, 5),
(5, 3),
(2, 0),
(3, 2);
```

```
INSERT INTO MuscleGain (GoalsID, TargetGain) VALUES
(2, 5),
(1, 2),
(3, 10),
(4, 3),
(5, 7);

INSERT INTO Active (GoalsID, TargetActivity) VALUES
(3, ‘Soccer’),
(5, ‘Boxing’),
(1, ‘Calisthenics’),
(2, ‘Basketball’),
(4, ‘Swimming’);

INSERT INTO NutritionInputs (NutritionID, DeviceID, UserID, Calories, Date) VALUES
(1, 1, 1, 2000, '2024-02-01'),
(2, 2, 2, 1800, '2024-02-02'),
(3, 3, 3, 2200, '2024-02-03'),
(4, 4, 4, 1900, '2024-02-04'),
(5, 5, 5, 2100, '2024-02-05');

INSERT INTO GenerateSleepData (DataID, Timestamp, Value, SleepID) VALUES
(1, '2024-03-01', 87, 1),
(2, '2024-03-02', 76, 1),
(3, '2024-03-03', 98, 2),
(4, '2024-03-04', 57, 2),
(5, '2024-03-05', 66, 3);

INSERT INTO GenerateRecoveryData (DataID, Timestamp, Value, RecoveryID) VALUES
(1, '2024-03-01', 73, 1),
(2, '2024-03-02', 64, 1),
(3, '2024-03-03', 95, 2),
(4, '2024-03-04', 63, 2),
(5, '2024-03-05', 74, 3);

INSERT INTO GenerateGoalsData (DataID, Timestamp, Value, GoalID) VALUES
(1, '2024-03-01', 97, 1),
(2, '2024-03-02', 54, 1),
(3, '2024-03-03', 98, 2),
(4, '2024-03-04', 95, 2),
(5, '2024-03-05', 60, 3);
```

```
INSERT INTO DeviceTracksData (DataID, Timestamp, Value, DeviceID) VALUES
(1, '2024-03-01', 97, 1),
(2, '2024-03-02', 54, 1),
(3, '2024-03-03', 98, 2),
(4, '2024-03-04', 95, 2),
(5, '2024-03-05', 60, 3);

INSERT INTO InsightMonitors (InsightID, Result, Date, UserID) VALUES
(1, 'You slept well last night', '2024-02-01', 1),
(2, 'Your recovery score is improving!', '2024-02-02', 2),
(3, 'Keep up the good work on your goals!', '2024-02-03', 3),
(4, 'Consider adjusting your nutrition for better results', '2024-02-04', 4),
(5, 'Remember to stretch before exercising’, '2024-02-05', 5);

INSERT INTO InsightProvides (InsightID, Result, Date, DeviceID) VALUES
(1, 'Recovery decreased', '2024-05-01', 1),
(2, 'Sleep duration got better', '2024-07-02', 2),
(3, 'Bedtime becomes earlier', '2024-02-03', 3),
(4, 'Nutrition needs more calories', '2024-02-04', 4),
(5, 'Activity updated’, '2024-02-05', 5);
```

Questions for TA:

Double check our usage for UNIQUE in Date in all entities?

Check FDs

Generate Data table

Not Null Keys

On DELETE/ONUPDATE

How many decompositions for BCNF for it to be reasonable