



# SAFeDJ

## SAFeDJ Community: Situation-Aware In-Car Music Delivery for Safe Driving

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### Motivation

About 1.2 million people die and 50 million people are injured or disabled on roads every year; Approximately 600 people die everyday due to drivers with a diminished vigilance level, e.g., driving while fatigued or with negative emotion.

Listening to suitable music while driving can improve:

- (1) Driving Performance; (2) Mood and relax body; (3) Driving Safety.

SAFeDJ Community FOCUS ON: Situation-aware music delivery to drivers and help them

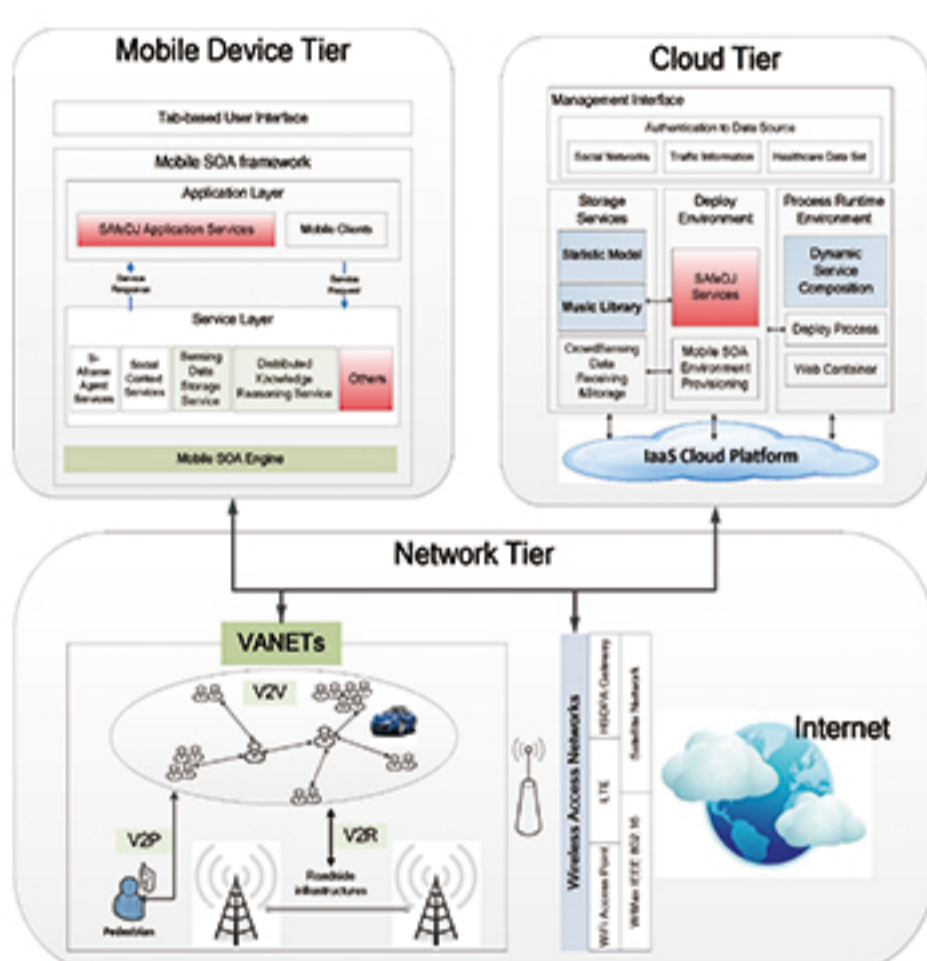
- (1) Reduce driving fatigue;
- (2) Ease negative mood.



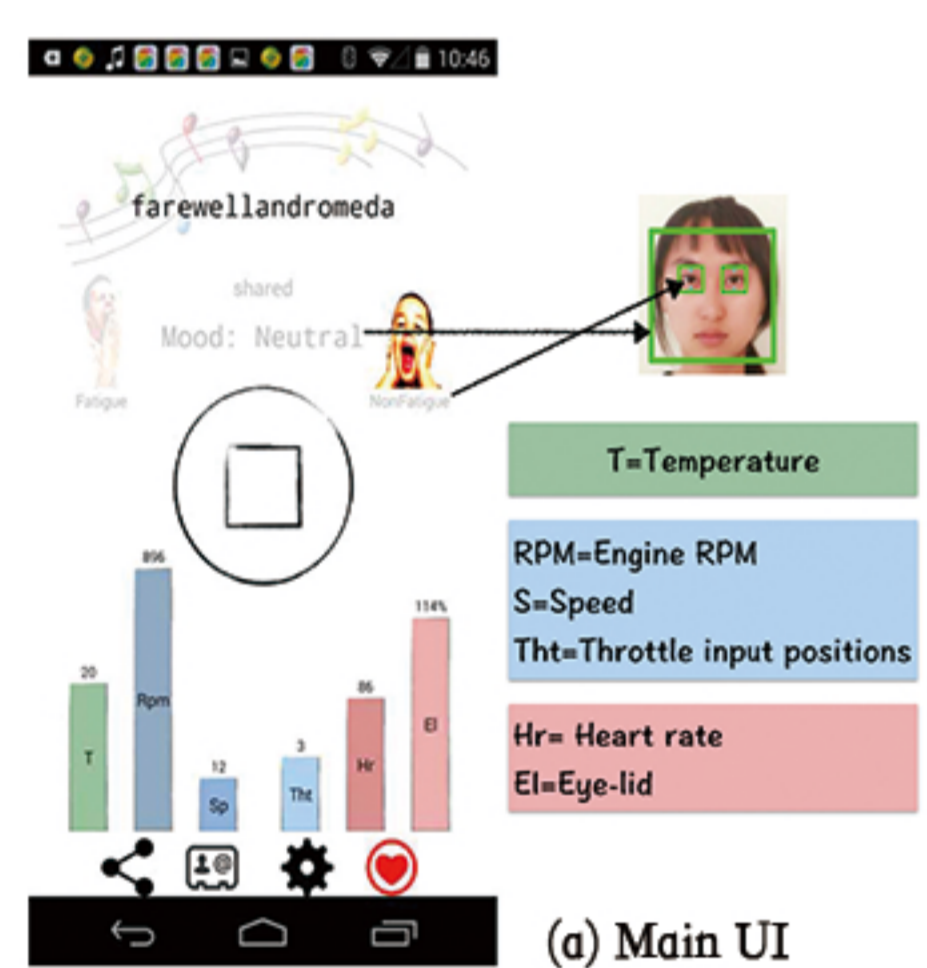
### Innovation and Uniqueness

FIRST mobile music recommendation or delivery application designed for vehicular users; Not based on listening behavior or history, but on sensing data for situation and context awareness; Consider the status of the drivers, the environments of the vehicles simultaneously in real-time.

#### Overview



Three tiers of Community System architecture



(a) Main UI



(b) Music information shared in Facebook

#### Implementation Techniques

Techniques for SAFeDJ Community Implementation:

SQLite database and lightweight ontology-based similarity computation methods for storing and interpreting the integrated sensing data on mobile devices;

RESTful Web service, Apache ODE, JBoss jBPM and a series of open source packages for setting up the cloud platform to communicate with mobile devices efficiently.

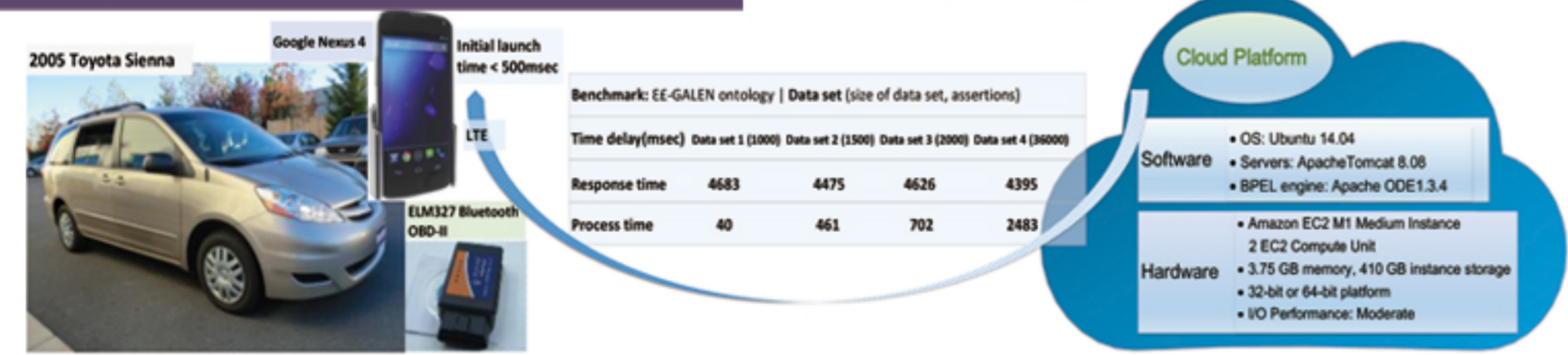
Main UI Design and Functions:

- 1.Driver's real-time fatigue and mood states;
- 2.Real-time information and data about car states, road situations and human being states;
- 3.Save the favorable music and check the account information;
- 4.Personal preferences setting;
- 5.Sharing listening music information in Facebook.

Music Cloud Sharing Method:

- 1. Use the IBM IaaS cloud - SoftLayer to set up cloud server and file system to store and persist the music uploaded from different users of SAFeDJ;
- 2. Use the Facebook API (FB.api('/me/feed', 'POST', ...)) of javascript and jsp, to enable the mobile-uploaded music be automatically shared to the users' Facebook accounts.

### Experimental Results



Time Efficiency:

The cloud platform of SAFeDJ can finish the information retrieval tasks and return the results to a mobile device efficiently in real driving scenarios (less than 7s even in quite intensive computing situations when the size of data set is 36000).

### Conclusion and Future Work

SAFeDJ

- Situation-aware in-car music delivery application for promoting safe driving;
- Based on a cloud-based network architecture;
- Multi-dimensional sensing devices collecting in real-time and driver+car+road situation;
- Mood and fatigue degree analysis;
- Music Mood intelligent mapping;
- Context-aware social network connection.

Future Work:

- Experiments on more geographic and traffic situations;
- Explore the relations between traffic conditions, health data and music preferences.

### Supportive Procedure

A: Collection of sensing data



OpenCV2.4.9-based Detector for Facial Expression and Eye-lid



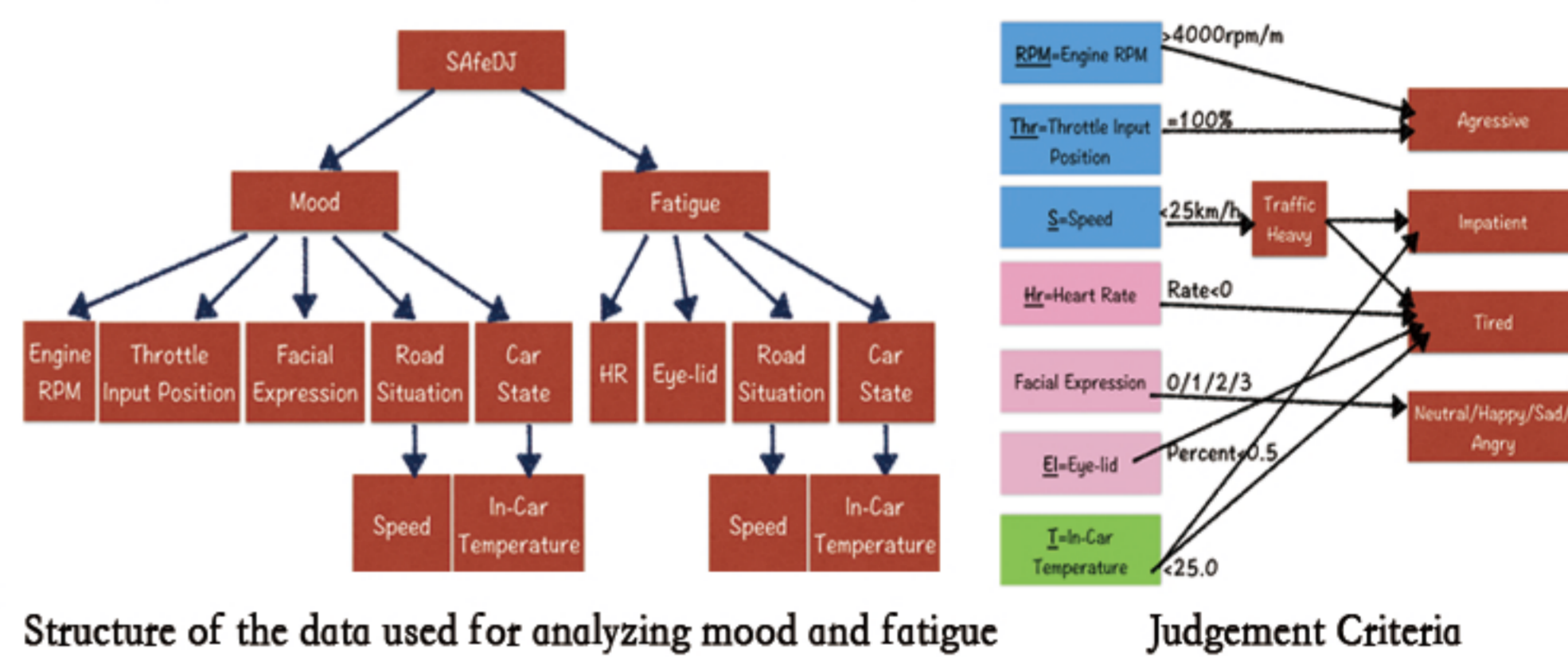
Facial Expression Detection:

Use camera to capture the driver's real-time facial photos; Detect face using the cascade classifier in OpenCV-2.4.9 library; Send into facial expression recognizer to classify into the classes of mood accordingly.

Eye-lid Detection:

Use haarcascade\_eye.xml and cascade classifier in OpenCV-2.4.9 library; Use two detection squares to capture the eyes and the length of side depends on the distance from one's upper lid to the lower lid to detect part of the fatigue degree.

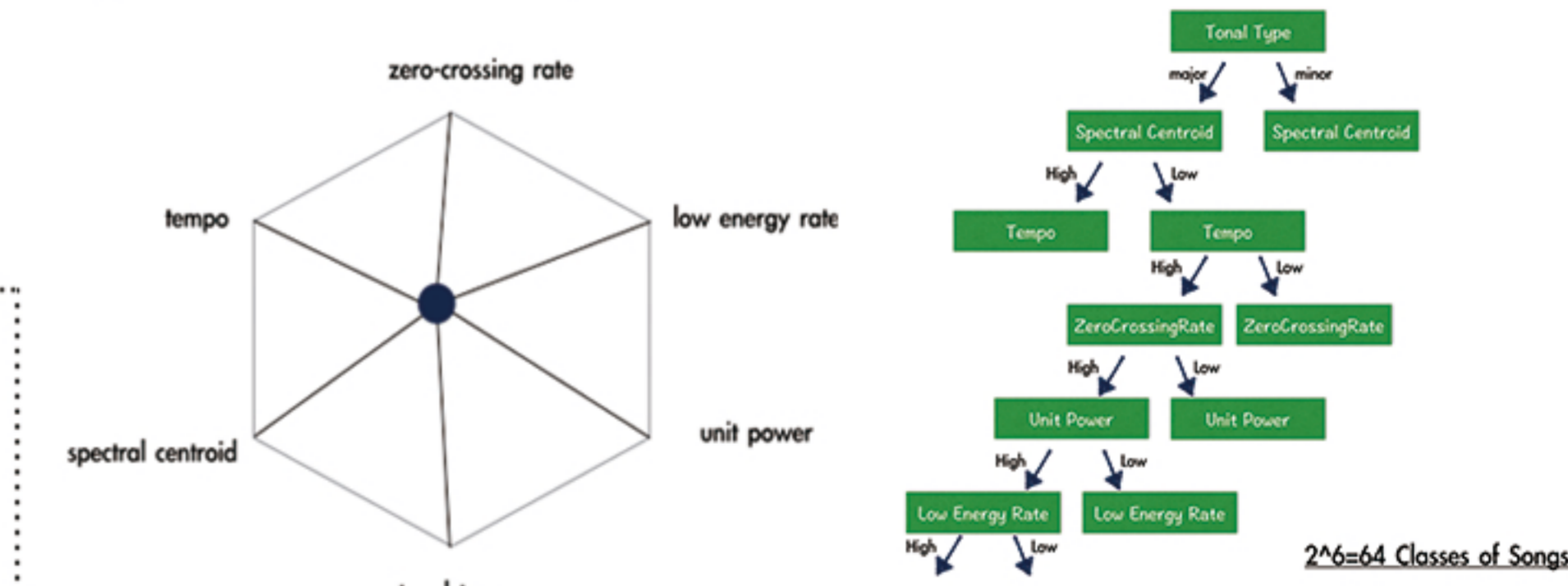
B: Analysis of driver's mood and fatigue



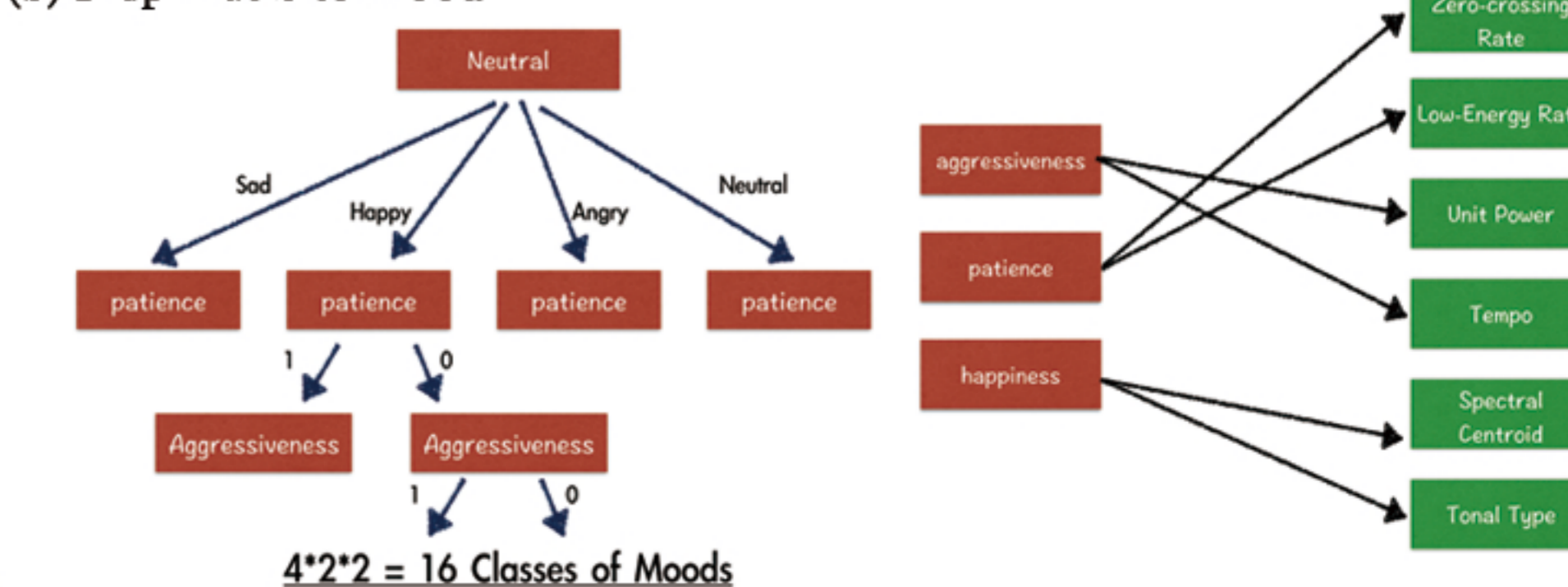
C: Music mood mapping

(a) Extract music features to classify songs

e.g. Here comes the Sun.mp3---->Feature Extraction----> 6D Dimension



(b) Map music to mood



(c) Decide which song to pick up after detecting a certain mood

- 1. Look for entries that match all indexes (aggressiveness, happiness, patience, if no entry found, go to 2, else go to 3);
- 2. Look for entries that match happiness indexes (if no entry found, go to 4);
- 3. If more than one song selected, randomly pick one from the selected song pool;
- 4. Randomly pick one from the song pool.

### References

[1] X. Hu, J. Deng, W. Hu, G. Fotopoulos, E.C.-H. Ngai, Z. Sheng, M. Liang, X. Li, K. Shafiq, V. C. M. Leung, S. Fels, C. Lau, Y. Kwok, "SAFeDJ: Situation-aware Music Delivery for Drivers", ACM MobiCom 2014 Mobile Application Competition final. (acceptance rate 14.0%=7/50) Available: [http://www.sigmobile.org/mobicom/2014/app\\_finalists.html](http://www.sigmobile.org/mobicom/2014/app_finalists.html)  
[2] X. Hu, J. Deng, W. Hu, G. Fotopoulos, E.C.-H. Ngai, Z. Sheng, M. Liang, X. Li, V.C.M. Leung, and S. Fels, "SAFeDJ Community: Situation-Aware In-Car Music Delivery for Safe Driving", in Proc. ACM MobiCom 2014

