

Coffeebot

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Executive Summary

Individuals often stay up late using the help of stimulants such as adderall and caffeine. However, significant mental degradation can occur without the individual's knowledge, causing them to work with below their maximum efficiency without realizing. We propose Coffeebot, a system that monitors a user's fatigue to detect when they are likely falling asleep. The system then automatically brews coffee, a popular stimulant, in order to keep the individual awake. The system would also allow a user to brew coffee on other occasions when they might be tired, such as on waking up, and we propose a smartphone application allowing the brewing of coffee at other times, as well.

Requirements

Stakeholders

User

The user is the one who owns Coffeebot. Coffeebot's fatigue detection system will be synced into this user's laptop camera to detect signs of drowsiness.

Family Member Living in the House

Often times, there will be other family members living with the user. They can also benefit from the system by having readily accessible coffee.

Teammate/Co-worker

A team or a co-worker is someone who is working with the user on projects.

User Stories

As a <role>	I want <goal>	So that <reason>
User	to be able to stay up late at night	I can finish all my work
User	to be able to have coffee ready whenever I'm sleepy	I can avoid falling asleep
User	to have coffee ready for me in the morning	I can be more awake in the morning
User	to be reminded whenever I'm falling asleep	I am aware that I need stimulants like coffee
User	to have readily brewed coffee whenever I want	I have instant access to ready coffee
User	good quality coffee without going out	I don't have to go out just to get coffee
User	to control the coffee maker with my smartphone	I can brew coffee anytime anywhere
Family member living in the house	to have easily accessible coffee	I can have coffee whenever I want
Family member living in the house	to have an automatic coffee maker	I don't have to make and serve coffee for others
Teammate/Co-worker	to ensure the user finishes his/her portion of the work	we can complete the project on time
Teammate/Co-worker	to ensure the user shows up to work on time, feeling awake	we can start our day without waiting for the user being awake

Due Diligence

Volkswagen's Fatigue Detection System

Volkswagen's Fatigue Detection System is an innovative system built in many Volkswagen vehicles to monitor the driver's conditions when driving for any signs of fatigue. Using a video sensor which is positioned to monitor the driver's head, the system is able to constantly record the user's current state and look for any deviations that might show signs of fatigue. The system constantly monitors the movement of head, eyes, and eyelids and uses a predictive algorithm to calculate the user's fatigue level based on eye closure data. The system takes in parameters such as eyelid opening, head position, and gaze position. If the system detects that the driver is starting to fall asleep, it provides a visual and acoustic warning for the driver to take a break. If the driver does not take a break over the next fifteen minutes, the warning is repeated.

Volvo Dashboard Sensors

Volvo is currently experimenting with dashboard-mounted sensors that detect driver's inattentiveness or fatigue. The system consists of small LED sensors that emit a beam of infrared light onto the user's face, just beneath the threshold of visibility, allowing the built-in system to read the user's facial cues to detect if the user is paying attention. It focuses on aspects such as the position and the angle of the user's head, how open the user's eyes are, and whether the user is looking forward. The system would then alert the driver and adjust the safety support system of the car accordingly.

Barisieur Coffee Brewing Alarm Clock

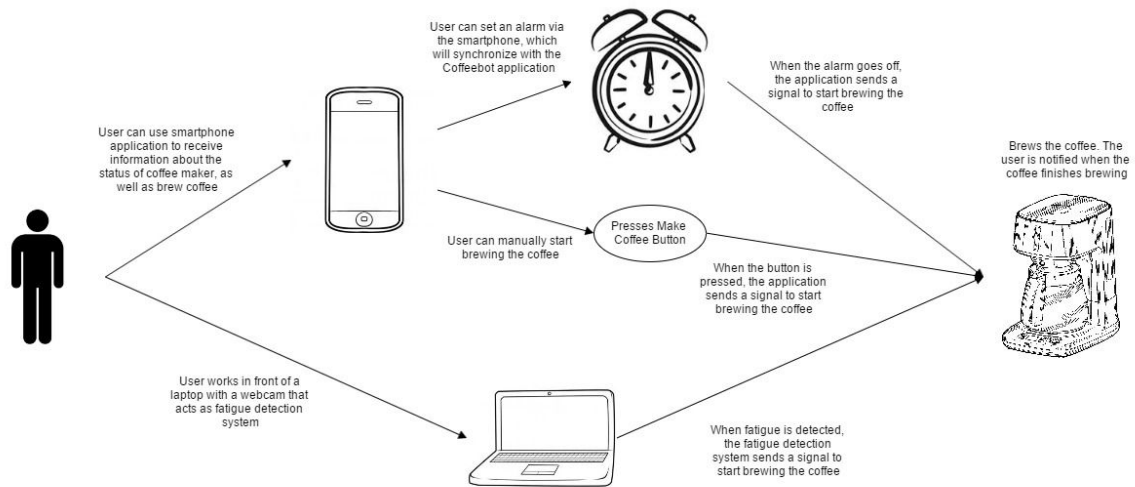
The Barisieur Coffee Brewing Alarm Clock is an alarm clock that is designed to wake the user up with a cup of freshly prepared coffee. Rather than waking up to the sound of an alarm clock, the Barisieur wakes the user up using the delicious smell of freshly brewing coffee. Every night before going to sleep, the user will have to fill the machine up with the right amount of water and ground coffee. The machine also provides compartments for milk, sugar, and extra coffee.

Tweet-a-Pot

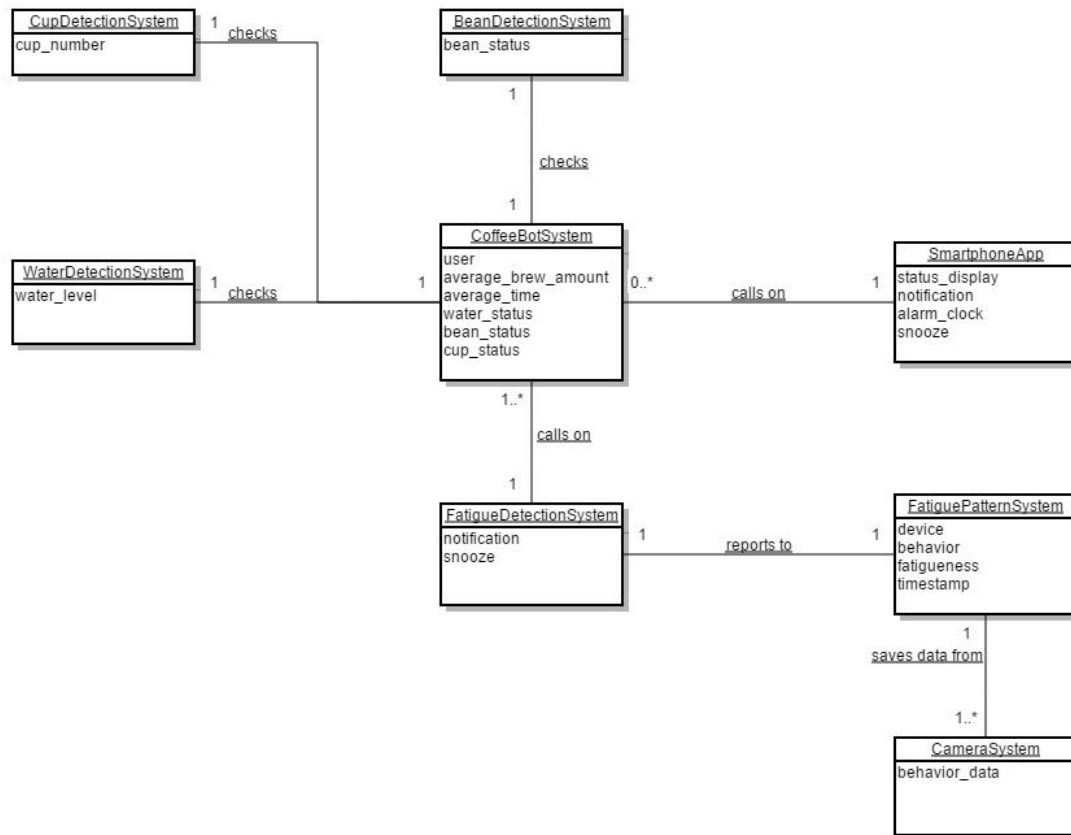
Tweet-a-Pot is a coffee maker that is remotely controlled via Twitter. It allows the user to make coffee from anywhere at any time as long as the user has cell phone reception, Twitter, and an Arduino board. The user will need a power switch, a tail, an Arduino board, a computer running the Arduino IDE and Python, and a drip coffee pot. The receiving computer needs to be set up beside the coffee pot. At any time, the user can send a tweet about making coffee to the computer. The computer will receive it and send a signal to the coffee pot to start making coffee at that time.

Design

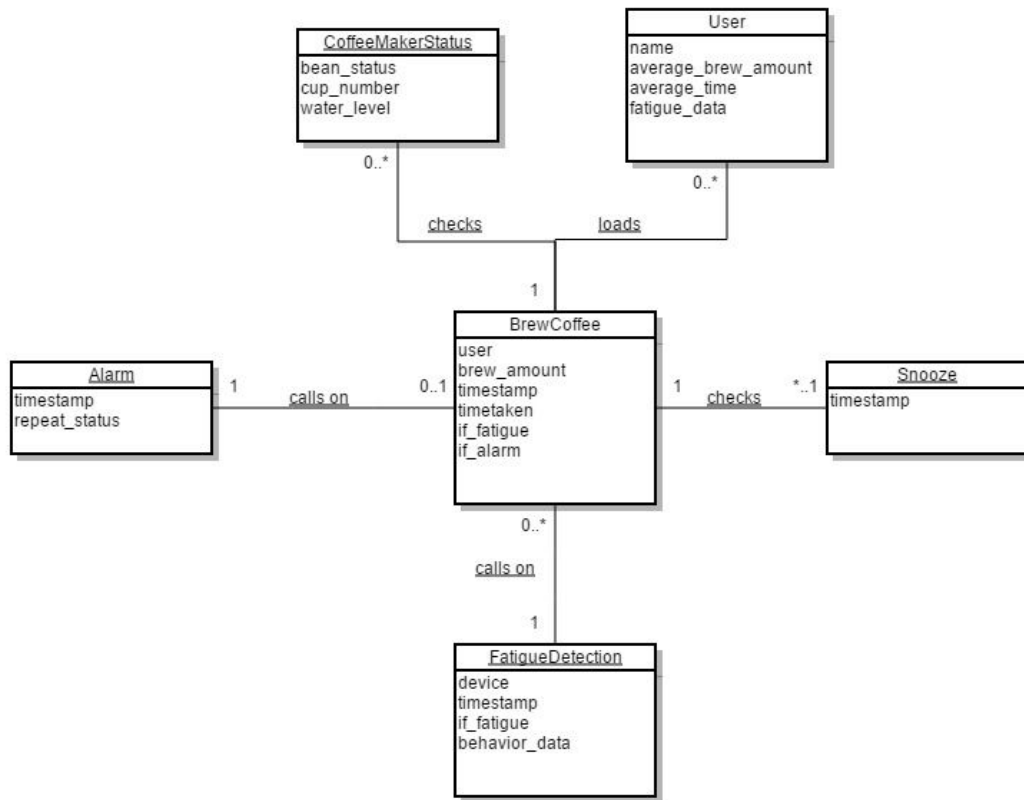
The Architecture Model



The Class Diagram



The Data Model



The Coffeebot system has two primary functionalities that differentiates itself from a regular coffee maker: brewing coffee when the user is tired, and brewing the coffee on the set time.

First, Our Coffeebot system brews coffee when it detects that the user is tired. When it detects that the user is tired, the Coffeebot sends a signal to brew the coffee. To detect if the user is tired or not, the coffee bot uses its own fatigue detection system which utilizes the webcam on the laptop to detect movements. This system also harvests the behavior patterns, which allows it to get 'smarter' and be more accurate in fatigue detection. To do this, the camera system will store the behavior and movements of the user only from past couple of minutes. Parts of this data will be stored into the fatigue pattern system when the user alerts that the user is not fatigued when alerted, or manually tells the system that the user is fatigued.. This triggers the system to retrieve few minutes of behavior data from the camera system, and stores it within the fatigue behavior system database. For example, if the user received the notification that the coffee is ready but clicks 'Not Now' in the application, the fatigue pattern system automatically retrieves data from the camera system, stores it within the application, and marks it as 'Not fatigued'. Once it is saved, the detection system will respond less frequently to user's movements that are similar to the ones that are marked 'Not fatigued'.

In addition, the Coffeebot system can synchronize with the smartphone app to brew coffee on-the-go. Whenever they press 'Make Coffee' button on the smartphone application, the coffee will start brewing. The application also synchronizes with the smartphone's alarm clock to brew coffee when the alarm goes off. This is especially helpful for users who needs a fresh cup of coffee to start the day. Once the timestamp on the alarm clock matches the current time, it will send a signal to the coffee maker to start brewing the coffee. To ensure fresh cup of coffee at the right time, the coffeebot system will calculate the average time it takes for the user to retrieve the coffee and the average amount of coffee the user manually brews each time for each user, stored under their username. By calculating the average time, the Coffeebot can estimate when to start brewing the coffee. For example, if the user takes about 10 minutes to grab the coffee after waking up and if the alarm is set to 7:00 AM, the Coffeebot will brew the coffee so that the coffee finishes brewing around 7:10 AM. Coffeebot also stores how much the user brews each time to estimate the amount of coffee needed for the user to keep them awake. This ensures that the right amount of coffee is brewed each time, at the right time.

In addition to brewing the coffee remotely, the smartphone application also displays the coffee maker's status by connecting to the systems that are connected to the Coffeebot system. It checks if the coffee maker needs attention (such as low water, low bean count, or low number of cups) and displays the information on the application. Last but not least, there are times when the user does not need a cup of coffee when they are fatigued or when the alarm goes off. To compensate for this, the user can snooze their systems to ignore all non-manual coffee brewing signals until further notice.

You can find screenshots of our design on [Github](#), or at their [own URL](#).

Cost Benefit Analysis

In comparison to the fatigue detection systems described above, Coffeebot provides the user with freshly brewed coffee whenever the system detects signs of drowsiness from the user. It can also brew coffee on other occasions when the user might be tired, by allowing the user to control Coffeebot using a smartphone application. Therefore the usage of the system is not does not limit the user to be at a certain place.

In comparison to the Barisieur Coffee Brewing Alarm Clock, Coffeebot not only brews coffee when the user wakes up every morning, but also brews coffee whenever the user is falling asleep. Whenever Coffeebot detects signs of drowsiness from the user, a notification pops up on the top right of the user's screen, which automatically brews coffee if the user hits "Thanks". This will give the user the necessary stimulant whenever it is needed.

In comparison to Tweet-a-Pot, Coffeebot offers the additional functionalities of fatigue detection, auto-synchronization with alarm clock or related applications. In addition, Tweet-a-Pot requires the user to have a Twitter account while Coffeebot does not require the user to register for anything.

The core value that Coffeebot provides is that it is a simple, user-friendly system that combines many essential functionalities to help students succeed. Many of the similar systems in the market offer single functionalities, like just brewing coffee in the morning or just keeping you awake. Coffeebot offers a way to combine all these essential functionalities and even provide many more to offer a complete package to students. It takes into account all the essential needs of a student when it comes to trying to stay awake, and provides the student with a system that facilitates all of these processes.

Coffeebot is mainly targeted towards students to help them concentrate when they need to stay up late. According to studies, the Grade Point Average of a student is strongly correlated to the income you will earn after you graduate. A study of compensation in investment banking by WallStreetOasis.com shows that a typical first year associate make an average total compensation of \$79,700 for a GPA of 2.9 to 3.1, \$99,700 for a GPA of 3.2 to 3.4. This shows that with a slightly higher GPA, at 3.5, a first year's associate's compensation will increase to around \$137,400. As we can see, GPA is very important to students as it directly affects the student's income after graduation. Therefore, a college student would be willing to invest some money into a one time purchase like Coffeebot since in the long run, the cost will be very minimal compared to the value that Coffeebot provides.