

Problem:

Daytime sleepiness can be caused by a variety of pathophysiologies; however, in some people it is simply due to waking up during certain stages of sleep. Many people do not set alarms based off of their sleep cycles – they set them based off of when they need to wake up. This can lead to alarms going off while a person is in deep sleep which can cause symptoms of daytime drowsiness even though the person got their number of hours needed per night in.

Proposed Solution:

To solve this problem, it will be necessary to track a person's sleep throughout the night to determine what stage of sleep they are in by using an electroencephalogram (EEG). Typically, EEG's are performed by having the person wear a large, clunky headpiece with many wires extending from them. This would be extremely uncomfortable and unrealistic to use especially if a person is trying to sleep. Because this problem is only detecting sleep stages, only a few electrodes are needed instead of a vast array, thereby limiting the size of the device. To make it comfortable, the electrodes can be placed within a flexible headband that minimizes irritation. The wires can also be gotten rid of by using Bluetooth to send data to one's phone. On the phone app, the user can input a time range they are okay with their alarm going off. Then, during sleep, the device records what sleep stage a person is in and sets the phone alarm off only when the person is in light sleep, avoiding the problem of daytime drowsiness from waking up during deep sleep.

Demonstrated Features:

1. EEG and ECG Sensitivity - ability to measure electrical activity from the heart and brain
2. Wireless communication - sensors and microcontrollers wirelessly communicate with apps/websites through WIFI.
3. Health Metrics - display information to the user in both live-feed and 'night's sleep' summary form. Heart Rate, time asleep etc.
4. Easy Fit - package sensors and controller in comfortable, lightweight manor to allow for seamless integration into comfortable sleeping.
5. Alarm Feature - allow user to set desired wake up range and wake up the user during the correct sleep cycle stage.

Available Technology:

All components for this project are currently available. EEG technology has been around since the 1920's, and there are now various integrated circuits that can perform the biopotential data acquisition, amplification, and filtering. In terms of wireless technology, the ESP32 has Bluetooth capabilities to meet the demands of this project.