Ecological Momentary Assessments (EMAs) are brief surveys designed to gather information about a person’s current state1. They give healthcare providers information about the subject’s immediate condition in their natural surroundings. EMAs attempt to reduce the sampling bias and user recall errors that post-experience surveys generate. However, the usefulness of EMAs depend on the correct assessments being given at the correct time.

Our project uses wearable and mobile technology (Apple Watch, iPhone) to send short, pertinent EMAs to subjects based on sensor-detected activity levels. The goal of the project is to identify individualized activity levels in people who have trouble delivering accurate self-reports to their health care team.

Historically, experience sampling methods have included low-tech implementation, e.g. personalized journals and alarms or stopwatch prompts2. More recently, researchers have begun implementing more modern solutions to present EMAs to their subjects, such as smartphones, emails, and text-messages3. However, without tracking any activity input of the subject, these solutions require pre-planned prompt times or material conditional logic to deliver survey prompts. These methods risk the EMA being sent at an inappropriate time or sending an EMA that is not applicable. This in turn can habituate patients to ignoring the prompts because the pertinence of the survey is not apparent or they have trouble answering questions that are not relevant to their situation4.

Our project tracks the user’s activity via the Apple Watch’s internal accelerometer. The app uses a vector-magnitude algorithm to classify the user’s state as either ‘inactive’ or ‘active’. After a change in user state, the app signals that it’s time to deliver an EMA to the user. The user receives a notification on the watch and can respond immediately by using their iPhone to answer the assessment. The content of the assessment is based upon which state they are being surveyed, so the user will be presented with appropriate survey questions.

The app holds EMAs consisting of survey questions specific to the individual person. A researcher or healthcare provider may provide prompts that are most common to their patient’s usual ‘active’ activities (‘washing dishes’, ‘gardening’) and ‘inactive’ activities (‘napping’, ‘reading’). Each EMA also leaves an option for the user to self-report an activity by typing it into the app. The EMA responses are saved and can later be bundled together and emailed to the researcher.

This project is designed for a wide range of subjects, including elderly or low-mobility populations. The sensitivity of the activity detection can be adjusted by the researcher or healthcare provider so if a person is not very active, the app can still detect small or subtle movement. Commercial activity trackers like FitBit or pedometers rely on step counts or GPS signals5 which precludes the activity tracking of those who move slowly in small places or are in wheelchairs. Our app can detect overall motion of the entire body, allowing for a broad range in the types of subjects it can serve.

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2Stone, Arthur A et al. “Patient non-compliance with paper diaries.” BMJ (Clinical research ed.) vol. 324,7347 (2002): 1193-4. doi:10.1136/bmj.324.7347.1193

3Cohn, Amy M et al. “Promoting behavior change from alcohol use through mobile technology: the future of ecological momentary assessment.” Alcoholism, clinical and experimental research vol. 35,12 (2011): 2209-15. doi:10.1111/j.1530-0277.2011.01571.x

4Shiffman, Saul. “Ecological momentary assessment (EMA) in studies of substance use.” Psychological assessment vol. 21,4 (2009): 486-97. doi:10.1037/a0017074

5https://help.fitbit.com/articles/en\_US/Help\_article/1136#gps, accessed August 27, 2019