

1) What is your innovative product/service?

Our product is a wearable patch, that analyzes the secretion of apocrine sweat quantitatively. High apocrine sweat secretion has many conclusions, and this device provides the service of tracking this amount on a personal level. It will, for the first few days, analyze the average secretion of stress sweat by a person, and would accordingly make a personalized threshold.

It is a multi-layered patch that consists of a layer of water that would be in direct contact with the skin. Sweat will be secreted into this layer of water- both eccrine and apocrine. The salt ions (sodium and potassium), from eccrine sweat will pass through a semipermeable membrane into another layer, consisting of pure water. The lipids and proteins from apocrine sweat, being macromolecules, remain in the first water layer.

The patch would have an outer rim with a 650nm source of monochromatic light and a detector placed at diametrically opposite ends, both of which would operate in the first layer of water to detect the concentration of stress sweat by measuring the refractive index of the solution, by detecting at what angle the light hits the detector. This device would also be connected to our app on personal devices via Bluetooth connectivity (see below). The outer water layer would contain pores which would regulate the volume of water through pressure control. The outermost layer would be a layer of polylactic acid (PLA) with a volume of air in between for extra capacity, as would the external covering of the patch. A silicon pad, with one adhesive surface, would be used to stick the entire product to the body, without any sort of discomfort.

To prevent sanitary problems, the biodegradable patch would be daily-disposable. The outer rim can be attached to the patch externally and is made for prolonged use.

2) What challenge(s) is your product/service designed to solve?

Every year, approximately 600,000 people fall victim to sudden cardiac arrests, and despite its ubiquity, most of them don't survive. As the name suggests, the majority of sudden cardiac arrests (SCAs) occur outside hospitals- without warning- and aren't able to receive the immediate treatment they need. After extensive analysis of the symptoms linked to SCAs, we have developed- CASI (Cardiac Arrest and Stress Indicator). This is a passive, user-friendly solution to detecting them before their onset

Our product has been made with a motive to majorly curb fatality in any possible case of sudden cardiac arrests, by serving as a pre-emptive indicator of any impending cardiac arrest. Moments before a patient suffers from a cardiac arrest, a lot of apocrine sweat (*stress sweat*) is released. Through CASI, we will be able to monitor this level of sweat secretion and observe to inform any irregularities in sweat discharge.

Moreover, our product will be in the form of a patch that will be placed on a person's armpit. As it stops leaking of sweat outside the patch, bacterial decomposition of apocrine sweat, that causes the characteristic smell of sweat won't be possible outside the patch. PLA is moreover an aroma barrier blocking this odour completely. Prevention of this smell will lead to less social anxiety, to an extent, for instance, in job interviews, leading to overall better performance. This would be a huge step to solving the problem of bromhidrosis as well, which is a health condition caused by excessive body odor.

3) What are the key features of your product/service that make it special?

Along with our physical product, we will provide an app to the users that will entirely be personalised to their needs so as to improve their experience of this product.

Our product, CASI, has been designed such that it provides us with live time probabilistic figures of our anxiety/stress levels directly on our phones. This feature allows the app to know when someone is having problems and in a special case like cardiac arrest, it would notice irregularities in secretion levels and it can contact the hospitals around the persons locality.

Furthermore, since our program will run on devices it will have the data comprised from multiple different users. Based on this knowledge it will find correlations between stress sweat secretions and actual health conditions. This will help it in making certain thresholds for different people according to their BMI, and other body features and general disorders/diseases. For this, the app will inevitably also have high security for protecting people's private information from cyberattacks.

Moreover, the materials used in our product are extremely cost-effective and environment-friendly. PLA or polylactic acid is a bioplastic from the PHA family which is biodegradable and starts breaking down in regular soil in around 6 months.

Furthermore, our product is extremely cheap and affordable so as to make it a disposable accessory.

4) How is your product/service innovative and different from other product/services intended to solve the same challenges?

Our idea to use apocrine sweat, which would have otherwise be seen as a futile component, and turn it into something productive and beneficial, is what makes CASI a unique and an unprecedented product. The usage of stress sweat explores a mechanism which, along with giving us reliable data for analysis, also gives us more information such as figures regarding our metabolism or our average levels of stress.

The product is comparatively very cheap and has increased accessibility to the population. The idea of reusing the detector and connecting it to our personal devices is one which can benefit the users in both cost sensitivity, while allowing them to dispose of only the part which would have no use after a day, ensuring proper hygiene standards as well. Further, this recyclability allows for greater levels of efficiency of the product and it's general life cycle. Furthermore, the product is developed with the

current global mindset of conserving and preserving the environment. All of the materials used in making the reusable patch induce no harm to the environment in any way as they are either biodegradable or add minimal pollution in the first case.

Comments -

The device works on the principle of refraction of light. While the eccrine sweat containing sodium and potassium ions, among others, would osmose to the second water layer, the apocrine sweat, containing lipids & proteins would remain in the first layer due to the barrier, that is the semi-permeable membrane. As the volume of the first layer is very low, even minute changes in molecules present in a fixed volume, would result in change of mass, and hence change in density. As refractive index is directly proportional to density at human temperatures, this change in density would result in different optical dense mediums being present in the water layer.

A monochromatic light beam of $650\text{ }\mu\text{m}$ would pass periodically through this layer with a detector at the other end. The refractive index of water at room temperature is 1.33 while that of glycerol (basic building blocks of protein and lipids) is 1.47, so a appreciable deviation would be felt even on low amount of apocrine sweat, thus giving us a deviating angle. Finally, the angle of deviation would be used to calculate the concentration of apocrine sweat at a particular time t .

