Improve Working Mindfulness by Multisensory Smart-Office with Cloud Computing

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Abstract
Trying to recall our day life in office, we rarely can stay on our seat and focus on the job all the day. There are so many factor cause we lost our mindfulness on our job, for example, the chair is not fit for our body, the desk is too high to comfortable our arms…etc. Depends on the digital technologies, now we can sense human body by different sensor or camera, to log human body's status such like their skeleton, the pressure from their chair and desk, analyzing the sensing data and find out the relationship between environment comfort and human mindfulness. This paper is trying to define some parameters that connect with human feeling and body comfort, how to sense those factors, analysis them, and in the end, is it possible to use the final result to change the environment. We show an idea to enhance employee's working mindfulness, by sensing human acts through beacon, pressure sensor, camera…etc., collect those parameters and computes in cloud server, analysis collected data and find the best working model. We assume the experiment field is a smart office, lights and air conditioning are programmable, even the chair and desk are so on. Based on our behaviors patterns and environment mapping model, trying to make the environment fits our best working model, to ensure employees are always in a perfect working ambience.

Keywords: Body sensing, smart office, cloud computing, data analysis, interactive environment

Introduction

Trying to recall our day life in office, we rarely can stay on our seat and focus on the job all the day. There are so many factor cause we lost our mindfulness on our job, for example, the chair is not fit for our body, the desk is too high to comfortable our arms…etc. In the past, we can't make our office to fit every employee, not to mention that everyone's requirements might change every day by different propose. Depends on the digital technologies, now we can sense human body by different sensor or camera, we can analysis those sensing data and trying to figure out is a person comfortable or not, according to that result, controlling the environment parameters to make him feels more comfort.
This paper is trying to define some parameters that connect with human feeling and body comfort, how to sense those factors, analysis them, and in the end, is it possible to use the final result to change the environment.

Body Sensing & Environment

Human's mindfulness is affected by environment factors. Temperature, lighting, humidity, noise… etc., can always interfere our body to distract our work. In the other, a good environment can make us concentrate on the job. About the relationship between environment and mindfulness, Hiroshi Ishii had mentioned in Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms (Hiroshi Ishii, Brygg Ullmer, 1997). He put forward this idea that how to make environment message combine with an office area in a not interfere, but can be aware easily way. This is a way to make human can focus on their job, without too many environment message distribution. In our research, we want to follow the idea which environment is connect with human mindfulness, but revers, we are trying to control the environment to fit human requirements.
Here are some body and environment sensor we may use in this research:

Camera
The most important factors in this paper is a human upper body skeletal tracking, we can find out a person's fatigue through their sitting posture, the degrees of curved spin, the angle of head and neck, two shoulders position…etc., those parameters can be good resource to define human fatigue level. In this research, we use Kinect Camera and its Joint Hierarchy (see Figure 1) to capture human skeleton. The original hierarchy has 20 different joints. In our research, we are using SDK 1.8 which has Seated Mode to capture upper body only. And it's able to detect Hierarchical Rotation and Absolute Player Orientation (see Figure 2); these are making us easily to get the correct value from the target.

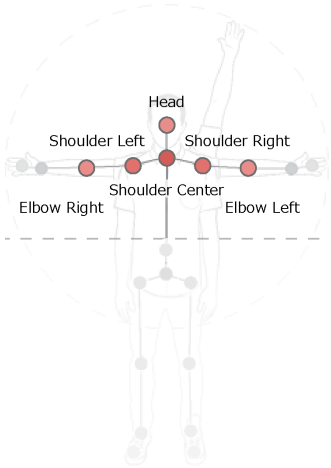

Figure 1: Joint Hierarchy (Microsoft. Kinect SDK)

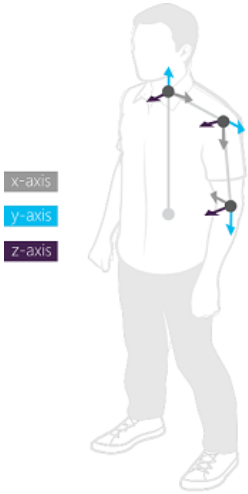

Figure 2: Hierarchical Rotation (Microsoft. Kinect SDK)

Flexion/Pressure sensor

Normally, human will relaxing their body by leaning back on their chair when we feel exhausted. According to our fatigue level, this action will give chair different extents pressures. We can quantize this pressure value to mapping into a fatigue level list, getting a relative value about human fatigue. In this research, we use simple flexion sensor (which can measure the amount of deflection caused by bending the sensor (SensorWIKI. Sensors: Flexion) also called bend sensor) to measure this pressure value, we set it up in the back of chair, especially the joints of chair, lightly leaning back or strong lie down on the chair will get different value and feedback, and we collect those values as computing resources. (see Figure 3)

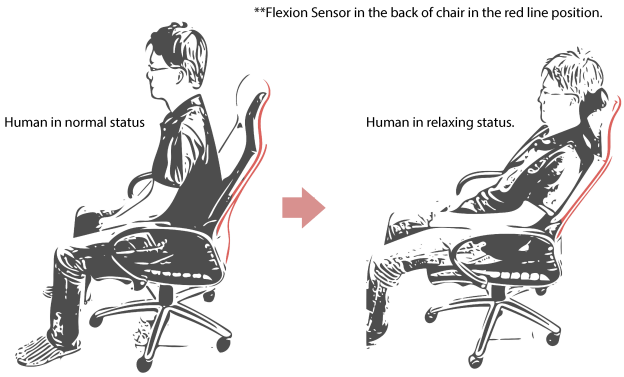

Figure 3: Fatigue measuring through flexion sensing on chair.

Environment sensing

Expect the factors of human body exhausted, sometimes people will lost their mindfulness because of some external factors. It's hardly to define which external factors exactly affect human and how do they affect us, so we just consider some controllable environment factors: Temperature, Humidity and Lights. We record those factors' data value, and choose some colleagues to be experiment subjects, recording their behaviors such like relaxing on the chair, leaning back, which we get the information form flexion sensor on their chair.

In some cases, people doesn't feel exhausted but just want to take a walk in the office, we also define this action as mindfulness loses behavior. We setup some beacons on our office (as Figure 4), and use them to trace single person's moving path, use these data to create a pattern to recognize those mindfulness loses patterns. And mapping into the data we got form thermometer, Hygrometer, and Photometer to get a measureable model about environment and human mindfulness.

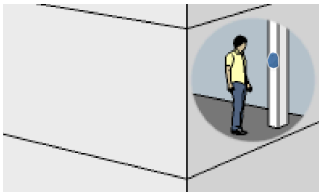
Figure 4: beacon in the aisle in office.

Clouding Compute & Data analytic

All the patterns and models creation we just mention on last section, we are using a service that calls Bistro, which is design by Institute for Information Industry (III, Taiwan). This service is a big data analysis platform, it integrated U.C. Berkeley BDAS (AMPLab–UC Berkeley, 2015), and Apache Hadoop (Wikipedia. 2015. Apache Hadoop), become a cross open source software platform (see Figure 5.)

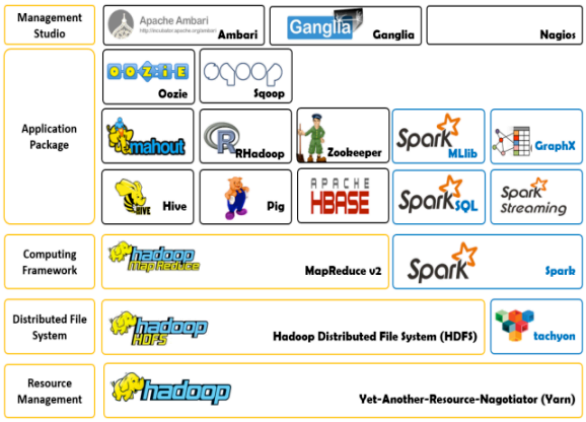

Figure 5: Bistro structure model.

Bistro allow users input data sets, calculates by customized function model, generalize and analysis those data to get particular patterns, models, or data analysis reports. In this case, all of the sensors are connected to our intranet, and the data of sensing logs will be sending to Bistro through RESTful APIs. According to our pattern recognize function, generating human mindfulness and environment mapping model (Figure 6).

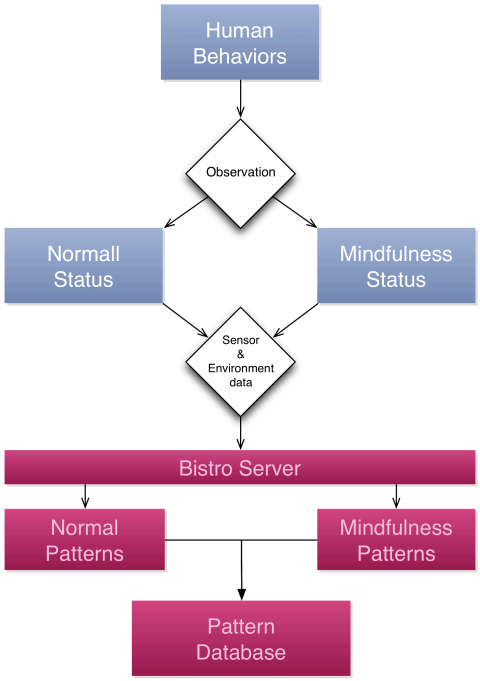

Figure 6: Human behaviors pattern contraction flow.

Environment control

According to the early result in this paper, we can use those sensors to recognize which employee is in mindfulness loses status or event close it, and follow our human mindfulness and environment mapping model to control the environments to make him feel comfort and become concentrate.

The programmable lights and electronic curtain can adjust indoor lighting, air-conditional can change temperature and humidity, electronic control desk and chair

can help human to sit on a correct pose to avoid getting tired. Those products are issued in smart office domain, but can be implementing on our research result. (Figure 7)

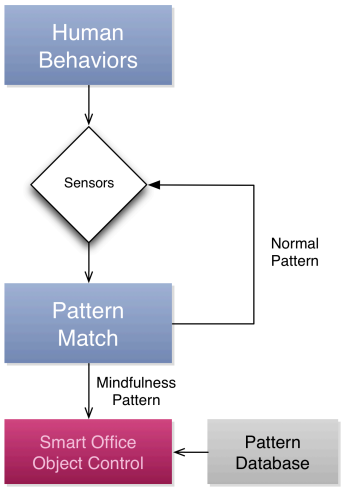

Figure 7: human behaviors and environment mapping model

Conclusion

In this paper, we are trying to define the connection between human mindfulness and environment; we are using some sensing technologies to detect human body factors, to determine people are losing their concentration or not. Final goal is we hope we can make human working or living in a perfect environment, if they are not, we can control the environments to comfort them without aware this progress.

Acknowledgements

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