Iron Man - Arc Reactor and Gauntlet

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Abstract
We are planning to implement a gesture controlled lighting mechanism. We are envisioning this system for indoor lighting purposes only. The gesture vocabulary would consist of waves and motions made with the palm. These gestures would be read with the help of the IronMan's Gauntlet. The "Laser Repulsor" in the palms would read the gestures and convey it to the system to trigger the appropriate, consequent change. The lighting mechanism on itself would consist of a length strip of RGB LED lights. With the help of the gestures, we would be able to turn the lights on and off, control the brightness, increase or decrease the length of the strip that gets illuminated.

Author Keywords
ArcReactor; Gestures; Accelerometer; photon; Gauntlet;

ACM Classification Keywords
H.5.m. Information interfaces and: Miscellaneous; H.1.2 User and Machine Systems: Human Factors.

Introduction
The past and current trends in the industry with respect to indoor lighting has always been focused on motion detection. Such a lighting was also imagined under the purview of security requirements [4]. Off-late, with evolution, these systems have also incorporated the

idea of presence detection [5]. Though the idea is convenient, energy-efficient, and reduces effort, it does not provide the user with more control. The system's affordance is pretty straight-forward and unidirectional. With the advent of smartphones and Internet of Things, the industry saw a huge number of smart bulbs with associated apps mushrooming. These smart bulbs provided the user with a multitude of functionalities. Some of the features included changing the color of the light, setting the brightness, automating the color according to the time of the day, selecting only the bulbs we want to glow out of the full array, to name a few. Some of the examples of these smart bulbs include Lutron[1], Philips Hue[3], LIFX[2], Ilumi. The interaction designs of these smart bulbs are pretty simple. These systems have Wi-Fi and could be controlled using the app. Some systems like the Philips Hue also have a specific remote control apparatus which can be used to control the bulbs. The bulbs were almost entirely operated with the app. The dependence on apps while using the smart bulbs is so high that we can summarize it with this joke:
Q: How many engineers does it take to change a light bulb?
A: 1 app

This excessive dependence on an app, or a remote brings us to our problem statement. We feel that the interaction design of these smart bulbs are in conflict with ubicomp's design principles [7]. Because we are using the app to communicate at every step, the presence of the intermediary computer is glaring and very pronounced. In an event of anything happening to the phone or the remote, the lighting mechanism would be rendered inoperable. This is why, we envision a system where with acclimatized usage, the system's behavior could be so deeply ingrained in the user's mental model that the user would forget the presence of the computers in between. A simple function of turning on the light switch would be seen as an extension of the human limbic movement, and would not be perceived as a conscious external interaction.

Related Work

The product that has come closest to this idea of gesture based lighting mechanism, based on ubicomp principles is the Desklamp[6].The lamp has a proximity and an IR sensor in front. By moving the hand across the face of the light, we can change the colors. Likewise moving the hand closer or away from the lights changes the brightness of the lights. Although this design looks very useful and seems to address all the problems that we have pointed out, there are still a couple of important functionalities that this system still does not address completely. Turning on and turning off this system is still a manual-switch which has to be flicked up and down. Moreover, the device is localized providing lighting in a limited space. Thus, to interact with the device, we have to be physically near it. We are looking at alighting system which spans an entire room. Consequently, we don't want the user to be walking up to the lights to wave and signal right at it. We want the interaction to be at user's leisure and comfort and from his own space.

Proposed Solution

The Iron Man's Gauntlet: The glove which can interpret hand gestures and convey the signals to the system. The system in turn has to be intelligent enough to make sense of the signals and provide the appropriate

output. For gestures, this is what we have thought of implementing:

1. Pushing the palm outwards and pulling palm closer to the body: To turn on and turn off the light respectively.
2. A slow wave of the hand from left to right: Controlling the length of the strip which gets illuminated.
3. A slow wave of the palm from bottom to top: Controlling the brightness of the lights.

Future Implementation:
Turning the palm by an angle : To control the color.

Implementation steps

The accelerometer and photon: The accelerometer is a device which is capable of sensing movements in all the 3 planes: viz, the X, Y, and Z axes. Our idea is to embed this accelerometer in the gauntlet. Whatever signals that the accelerometer reads, it'll pass it on to the photon. The photon-let's call it photon A, then relays this via Wi-Fi to the cloud. We'll have another photon-B connected to the cloud listening for signals from photon A. This photon - B will have the LED strip connected to it. Depending on the signals that it receives, it'll modify the LED strip. The logic processing and intelligence will have to be implemented at B's end.

A tiny led circlet resembling "The LaserRepulsor": This circlet would be around the accelerometer in the center of the gauntlet. The main purpose of this circlet is to provide feedback about the status of the accelerometer. If the device is up and running, it would glow with a soft pulsing light. In case of connectivity and Wi-Fi problems, it would glow red.

Workflow

Since the accelerometer-photon apparatus relies on Wi-Fi, there wouldn't be a need to be physically present near the LED lights. Moreover, since we are eliminating any kind of interfaces, there would be no hard interactions like clicking a button or flicking a switch. The idea is also to minimize the complexity, to keep the learning curve as steep as possible and intuitive.

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