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Fluffy FuwaFuwa Sensor Technology Opens Exciting New Possibilities

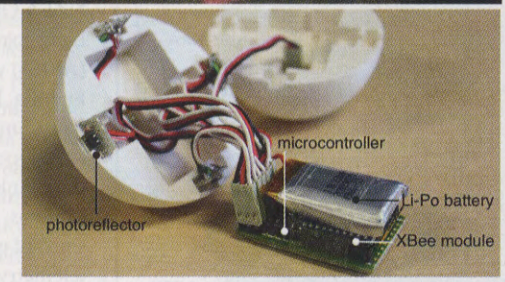
by Lem Fugitt, www.robots-dreams.com

SEE THE VIDEO!

For a brief overview clip of the project put together for SIGGRAPH Emerging Technologies 201, scan this code on your smartphone with a bar reader app or type in find.botmag.com/111102.

Technology development today faces some serious limitations that constrains its application and successful deployment, especially in non-traditional sectors. The two biggest limitations, at least from my perspective, are battery capacity/life and sensors. While there has certainly been a lot of progress in both areas over the past two decades, the core technology and design approach hasn't really changed very much.

In order to achieve radical improvements in the way we put technology to practical use some significant breakthroughs in both areas will be critical. Along those lines, one of the most interesting and surprising "thinking out of the box" sensor developments I've run across recently is the FuwaFuwa sensor module developed as a part of the Igarashi Design Interface Project under the auspices of the Japan Science and Technology Agency (JST) ERATO.



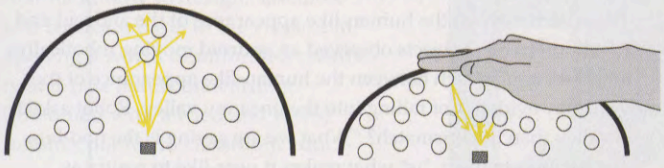
The sensor housings for the research project were 3D printed, though they could easily be mass produced by injection molding for a high volume/low cost application once the sensors are incorporated into a mass market product. The small sensor size and complete lack of any wires or connectors makes it very attractive for applications requiring sensors within soft objects with zero sharp edges or protrusions.

The raw sensor data, preconditioned by the onboard microprocessor, can be easily analyzed remotely to determine the relative pressure location in a 2D plane and the relative magnitude of the applied pressure. I suspect that for most practical applications relative measurements will be more than satisfactory rather than absolute, closely calibrated measurements.

"FuwaFuwa" in the Japanese language is a kind of onomatopoeic word that roughly translates as light/airy/fluffy, and that's exactly what the FuwaFuwa sensor module does.

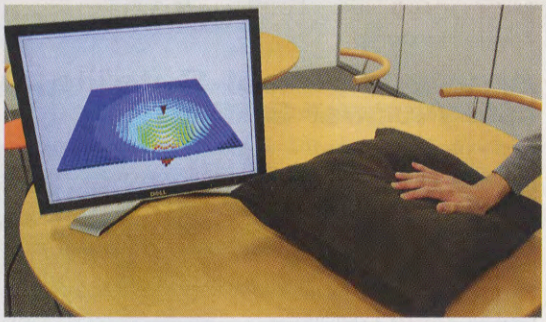
Small enough to fit in your hand, light, and totally self contained, the sensor module can be placed inside soft objects like a pillow, cushion, or plush toy with almost no modification. The underlying sensor principle is very straight forward. An IR emitter transmits light into the stuffing material surrounding the sensor. The reflected IR light is highly dependent on the compression of the stuffing material and its compression direction relative to the emitter transmission axis. Check out the details in the captions and look to www.robots-dreams.com and Robot for further updates.

Article developed by Lem Fugitt of www.robots-dreams.com via Japan Science and Technology Agency (JST), ERATO, IGARASHI Design Interface Project, www.designinterface.jp/en and adapted.here courtesy of *Robots-Dreams.*

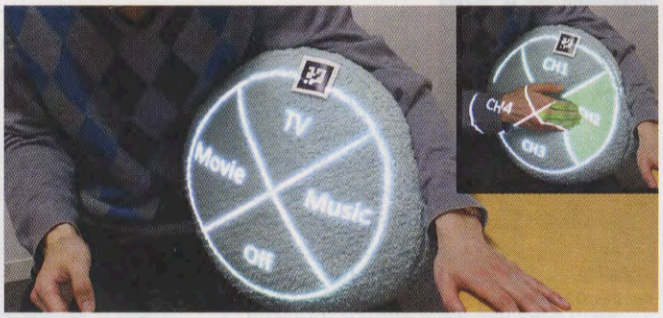


If the stuffing material is relaxed and not under compression then most of the light will disperse and not be detected by the sensor. As pressure is applied to the object the stuffing material becomes compressed and more of the emitted IR light is reflected and detected by the sensor.

The FuwaFuwa sensor module contains six IR emitters and photosensor pairs with each pair aligned along the major axes. Inside the module a small micro controller and XBee communications module process the raw data and transmit it wirelessly to a local server. Power is supplied by a LiPo battery contained within the sensor module.



The FuwaFuwa technology gets even more interesting when you consider that multiple sensor modules can easily be tucked away inside a pillow or cushion. By correlating the data from several sensors the object can become a video game controller, a musical instrument keyboard, a robot that responds to touch or caresses on different parts of its body, or a wide range of other useful things.



While exact positioning of sensor modules within the object isn't absolutely critical since small positioning offsets can be compensated for by the software, it is possible to detect the actual position using an IR sensitive video camera if the object cover material allows some of the IR light to escape.

The biggest immediate hurdle to be overcome before the sensor technology could be commercialized is battery life. The current LiPo battery can power a module for about three hours. That's fine for a proof of concept demonstration, but way to short for actual field use by end user customers.

It's common, perhaps even trite, to say that, "the possibilities are endless," but in this particular case I believe that would be an understatement. Once engineers and designers start to experiment with sensor technology like FuwaFuwa, the possibilities will indeed be endless.