1. **Customer Needs**

The Wireless Neural Recorder is special in a sense that its customers and users are likely to be two separated group of people. While health institutes, such as neuroscience research institutes, certified neurosurgery hospitals, buy WNR products, the device is installed and used on patients. The need for both groups overlaps to large extent, and can be concluded into four points below, listed in descending order of importance.

Safety is definitely the top concern for our customers, because of the invasive nature of the product. As a medical device, WNR is under US FDA medical device regulations. WNR is installed as an attachment on patient’s scalp, with its electrodes directly insert into patient’s brain. The working period lasts approximately five to six days. WNR needs to ensure the entire process to be completely safe, including external operations such as battery change and switch on/off to be stable and harmless. Further unfolding the safety requirements leads to a few more detailed technical limits: no detectable temperature raise in working device, no power surge in any case, and no feedback current leaking from electrode front end. The limit on temperature ensures no damage to skin or brain tissues; since the device will be turned on for a long period, any heat dissipated by the device will accumulate in the area, and the part that cannot be taken by humor flow will influence normal cell function. Power surge is listed as the most dangerous event, and should be prevented from the aspect of device design; that is, under any circumstance the circuit cannot possibly fall into a state that may result in power surge, such as short circuit.

Real-time, accurate, and comprehensive data collection is also required. Data read and transmitted by WNR is key for doctors and researchers to view patient’s brain activity and make judgments, thus data need to be accurate and reliable for customers to make correct, low-risk assessments. Most customers have experience with wired neural recorder, so the real-time data output should still apply to the wireless version. Real-time surveillance and danger prediction is then made available.

The next customer need is convenience, portability, and long-lasting. The currently existing human neural-activity monitor device all use wires for data transmission to the server end, which noticeably tether patients to a limited range of activity during the entire operation cycle. The greatest challenge and advantage of WNR is the riddance of wires, as well as its size dimension. Based on the feedback from doctors and patients, the top of the device, which is a chip attaching to the scalp, should be approximately 4mm by 4mm in size in order to fit on the fine scale of electrodes, and to reduce the discomfort of patients. Considering the active-time of WNR, to achieve customer convenience also means increasing its battery lifetime, which in turn reduces number of times to change battery of the device. The battery life should last at least 24 hours, because changing battery on the scalp twice a day is not reasonable for both doctors and patients.

WNR is a very useful implantable device for brain activity, and its usage should not be limited to only seizure patients’ monitoring. For most customers, especially research institutes, they want more applications to be developed on WNR platform in the future. With electrodes implanted inside the brain, they can do other operations such as brain stimulation, disease diagnosis, etc.