

A Case for IOT in Kidney Dialysis HealthCare

We have a growing population of patients needing kidney dialysis as they wait for transplant. There is growing technology around this critical function for people who's kidneys have or are failing, however there is still a long way to go in terms of treatment, and ongoing analysis for successful outcomes. I believe this is where IOT can come in.

Today there are many health centers that concentrate solely on providing dialysis treatment. There are also many people that still have to go to the hospital or emergency because of the level of care required, or complications arising from dialysis treatments, or the lack thereof. People either go into hospitals or dialysis centers multiple times a week for treatment, or they are provided equipment to do their treatments at home. The process of "filtering" the blood is done on a scheduled basis after a lengthy process of evaluation to determine care level. This evaluation is repeated on-going "as-needed" as the patient experiences negative health symptoms. Depending on their health profile, this can be quite impactful to the patient and costly for the care center. Rather than continuing with a system fraught with reactive procedures, and expensive "general treatments", it would be more efficient to implement a system that could provide instant biometric feedback and act based on that feedback – whether that action is proactive, reactive or immediate. This is as simple as collecting real-time biometric data, communicating that data and combining it with known treatments and procedures. I think this is where IOT can not only provide better insights and outcomes for the patient, but also for the centers and health care providers treating patients. These hospitals and clinics that are treating "out-patients" (no matter how or where they receive treatment) need better insight and more immediate data about what is going on with their patients, especially those who are at higher risk of dialysis complications (higher health risk profile) due to other medical conditions, for example diabetes, that may exasperate the need to adjust dialysis and other healthcare related actions more or less frequently. Emergencies always cost more than proactive and preventative care.

An IOT application to help with kidney dialysis treatment could involve:

1. The IOT Device:

A tiny device on (or ideally in) each patient that continuously measures blood levels for platelets, toxic load, other chemicals such as Creatinine, Insulin, Glucose, Nitrogen, etc., to gather the information needed to calculate in real-time how a patient's body is performing (some people don't lose all kidney function for example, so the treatment need is different). This can also help patients with diabetes not have to poke-test if the device is already present in the body and able to communicate results. This device would have to be extremely small, stationary (we don't want it floating around in the body), unobtrusive to the movement of the body, use extremely low power consumption (only power on at the intervals needed to measure and send data), and have the ability to communicate over Bluetooth or a similar technology to a nearby feedback device (for example a phone, tablet). (see next)

2. The App on an Edge Device:

The Edge Device in this case could be based on several profiles (a phone, tablet, dialysis device, etc. – anything that can be programmed and local), would house the IOT Edge Services and application, and should be able to receive the streaming biometric data collected by the IOT device, process it, and immediately do analysis on the "state" of the body. This can include calculations for the GFR

(Glomerular Filtration Rate), the current blood glucose level, and any other calculations needed to assess the patient blood profile real-time. That information could then be fed into a light weight predictive model that could provide feedback about when the patient will need to start and stop dialysis treatment (for example a countdown clock, instead of being based on a set schedule for x amount of time, be based on biometric feedback and more accurate calcs), send alerts within thresholds for various measurements - for example when a level is too high or too low, possibly provide dietary warnings/suggestions that affect blood profile. The Edge device would essentially provide regular, instant feedback directly to the patient and health care professionals involved with the care of that patient. That patient profile data can also be aggregated on the edge and sent to the care management team at various intervals for analysis and dashboard readout as to the state of their patients within demographics or certain health and risk profiles. This can help with planning and proactive care within the center on a daily basis.

3. Data in the Cloud

Obviously with volume of data being collected on the edge about each individual patient, that data is worth aggregating in the cloud to gain better insights as to the performance of the dialysis center(s) as well as patient outcomes. Data could be combined with several other types of business related data including the maintenance rates of machines, patient profiles and various care related metrics, staffing metrics, inventory metrics, etc. Various types of care metrics are quite extensive in healthcare and having the aggregated data in the cloud and viewable over time will provide the ability to extrapolate data for predictive analysis, as well as provide better patient outcomes in general because the level of insight will be elevated due to the use of biometric data collected real-time from patients.

I believe various bits and parts of the solution exist, it has just not been put together as an IOT solution. For example; machines exist, tests exist, and measurements are known. Therefore if "specific devices" can be built, programmed and placed, and applications can be programmed, data can then be collected and run through algorithms for real-time feedback. I'm not a dialysis treatment expert, but I can imagine this would ultimately lower costs, save time, and provide more positive treatment options for patients. Further, to anonymize the data and transport it to the cloud, deeper insights will be gained about the process, costs, and health profile of patients related to dialysis care. Outcomes will be greatly improved for patients, the care centers, and the related government and communal bodies that provide research, financing, tech solutions, and oversight for this vital healthcare function.