

Artificial Intelligence and Internet of Things in Healthcare (Blood Donor & Patients)

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Abstract—Healthcare is important for all living beings and the increased demand for quality healthcare is growing day by day. The key challenge is to provide healthcare for everyone in this world will take time, and it is a difficult task as well. It is time for us to change our approach to prevent disease by diagnosing it very early and provide appropriate treatment to save a life. We would like to approach it in reverse starting from a blood donor, reaching out to a Doctor/hospitals/providers and accessing the way they treat patients and their diagnosing methods and how the treatment is received by the patient and then finally based on demographic, treatment patterns, diagnose methods, we can identify disease in advance so that we can treat. On the other hand, we can also reach out to the quality blood donor constantly checking their blood pressure and diabetes level to choose the right donor at the right time in extreme circumstances. We are using IoT, Machine Learning, Artificial Intelligence and Cloud are the technical tools for our research.

Keywords:- *Health care, Artificial Intelligence, Machine Learning, IoT*

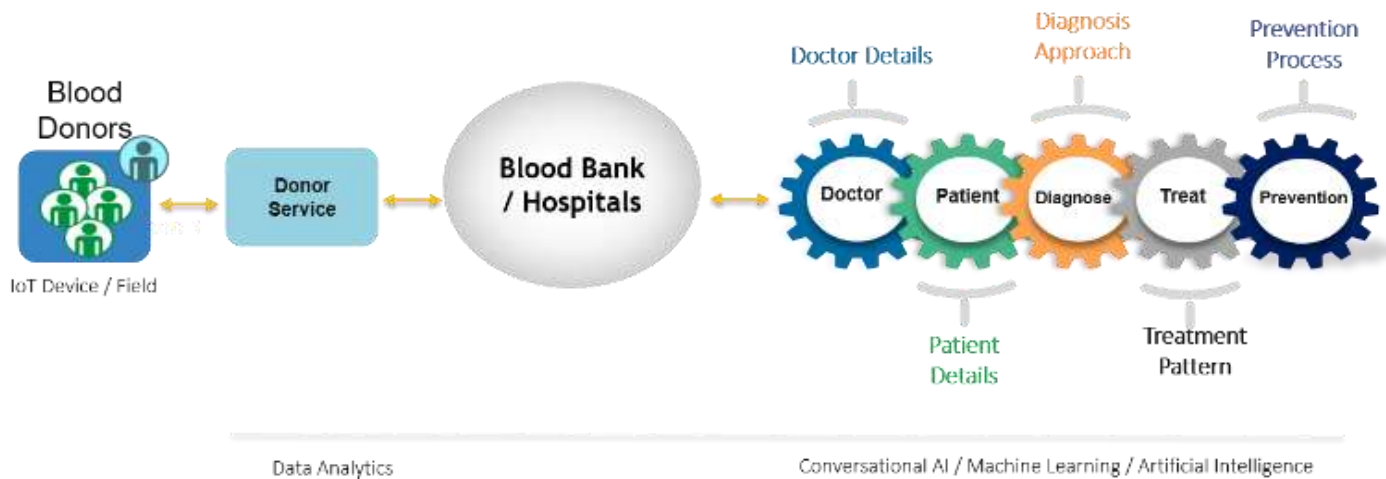
1. Introduction

Blood is more important for life. Always there will be an emergency for blood, so the hospital/provider/Doctors should always have contact with the donors(blood) and also they should aware of the donors health profile. It is a tedious job when the blood donors and hospital/provider/Doctors are not connected. The blood donors details like their blood pressure, pulse rates, diabetes level should be monitored before giving blood. This paper gives a view how artificial intelligence and internet of things makes blood donors and hospital/provider/Doctors to stay connected.

2. IoT Usage To Stay Connected

We aimed to connect people, process and technology to gather data, verify for its quality, apply algorithm(s) and finally prevent a life by providing proactive treatments. We would like to take a usecase based approach to explain for better understanding. We have some blood donors available who are individual or they are all registered under an organisation. The blood is being collected from the donor by the hospital/provider/Doctors, and then it is taken to the patient for further treatment. It is important for us to do a preliminary check about the donor and his health condition to use the blood. There is more circumstantial evidence that the rare blood groups are not available in the market and even if we get the donor for rare blood groups if they are not in the proper health condition, all our effort will go in vain. It is

important for us to constantly check the donor's condition even before we reach out to them. It is possible for the donors to use IoT devices that will constantly send their pulse rates, blood pressure level, diabetes and other basic requirements and this will enable us to reach out to the possible right donor to get the blood and treat a patient to secure their life.



If you look at the diagram above, the overall process can split into two dimensions. 1) How to identify the right blood donor, which will reduce our effort and increase the possibility of saving a life. 2) How to prevent or treat disease by approaching the patients proactively.

The donor can use IoT enabled devices such as apple watch, hairbrush and so on which will constantly send donors data and their current health condition. This way, we can prevent the donor from becoming a patient. The IoT will send the necessary data to the donor bank service where it will be stored for further analysis.

The donor need not know the patient details for whom we are donating blood. However, there are other possible connections here for us to see how the doctors are diagnosing a patient.

Each provider/Doctor has patient details. A patient can be a first-time patient or historical patient with representative treatments. There could be some accident cases that require treatments. These data can be captured and stored in a data lake. We can use machine learning predictive analysis algorithms and come to a possible conclusion to prevent few occurrences.

3. Case Study

Let us take a usecase where a patient is admitted to a hospital, and it requires immediate surgery. The possibility for us here to see the nature of the accident, frequency of the accident and place of an accident where it took place. Based on our analysis after applying various machine learning algorithms, we come to know that the accidents are taking place in a particular area irrespective of the driving ability. We extend our analysis and study further on the place the accident took place and learnt that there is a curve and the

road surface is slippery when the humidity level increases. Since the humidity level increases, it immediately demands to change driving conditions. However, before the driver adjusts to the circumstances they met accidents.

There is an opportunity for us to use Artificial intelligence by using machine learning algorithms, IoT devices & Conversational BoT services to react to the situation immediately and reduce the accidents by applying appropriate, on-demand signals, speed limits.

We have collected the sample blood donors data, the purpose of collecting the blood, sample patient data and we applied machine learning algorithms and few physical examinations to arrive at some conclusions. We aim this can be further developed with much more algorithms in place to both collecting the right blood donor in time and also prevent accidents considerably. These methods can also be used for additional use cases as well.

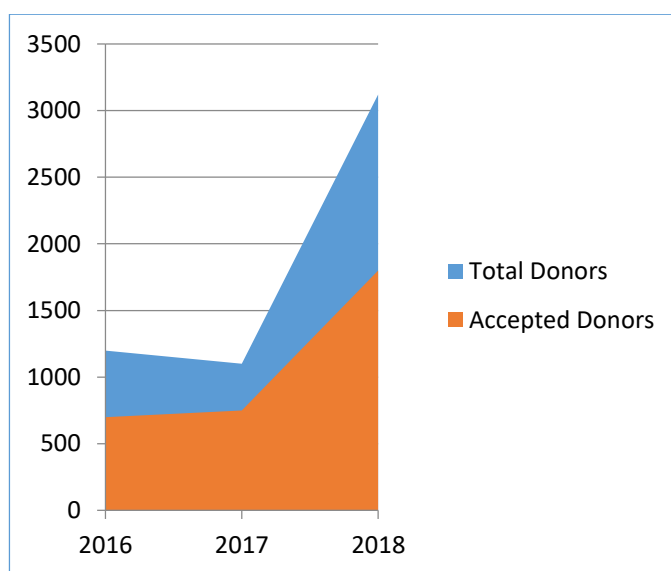


Fig. 1 Rate of successful blood donors before applying IoT

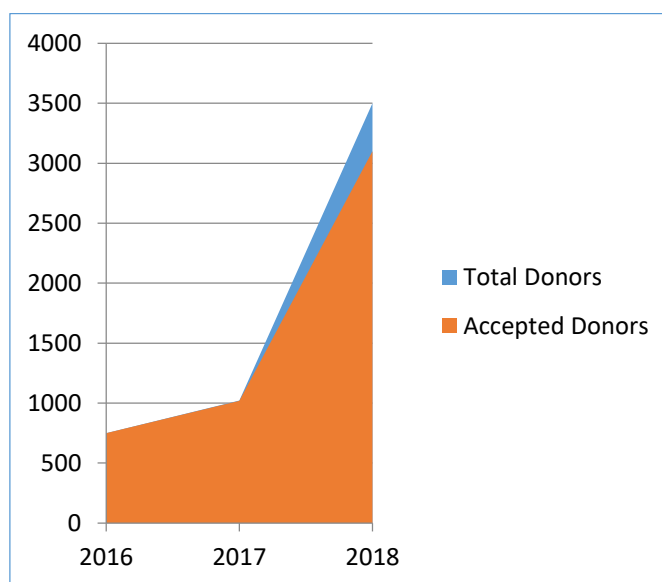


Fig. 2 Rate of successful blood donors after applying IoT

We have taken sample data from two different demography. The first chart sampling was done with 5420 blood donors spanning across three years. Fig 1 show sampling of 1200, 1100 & 3120 in the year 2016, 2017 & 2018 respectively. The successful blood donors recorded was 700,750 & 1800 in 2016,2017 & 2018 respectively. There were more rejections due to their preliminary blood verifications before donating the blood.

When we apply started using IoT as a technology by issuing hairbrush, watches to the blood donors, we were able to collect the data and were able to reach out to the right blood donors and were able to increase the success rate. Fig2 shows the sample data done for three years 2016,2017 & 2018 with 750,1020 & 3500 blood donors and the success rate recorded was 750,1019 & 3100.

4. Conclusion

We have aimed to choose a right use case and apply the connected technologies such as the Internet of Things, Artificial Intelligence using Machine Learning algorithms and BoT services. As described, we have taken sample data of blood donors from two different cities in the same assessment years. The total number of blood donors were different and in a particular City where we had technical support, we were able to implement the required technologies and were able to collect the data and continued to monitor automatically. At any point in time, we were able to get the top 5 quality blood donors in each blood group on givenpostcode. There were a couple of scenarios where we were not able to take blood, as the blood donors met accidents while they were heading to the hospitals. That triggered an important point to take this technology to a different level to prevent accidents not only for blood donors but also for all other commuters. We were able to monitor and collect sample patient data particularly the source of blood requirement, and we did a thorough study on the data we obtained. We observed that the accidents took place in a particular road range on a given interval. We also extended our study further and figured out that most of the accidents were happening during the summer time. We did a physical examine on the road with right people and figured out that due to heavy heat and humidity the road expands during summer and also the material used to construct the road is little sticky and that loosen the grip of the vehicle. Most importantly this road is a curve road, and hence the driver of the vehicle lose the grip, and in the end, they met accidents. Our recommendations are to install the IoT devices to reach the temperature out there and using Artificial intelligence, the signals are switched on, and the speed limits are instantly controlling the traffic.

This way, we were able to prevent accidents which were the most common usecase for blood loss and in the end the person who met an accident had to go for surgery, and the need for blood arises.

We have moved from system of records to a system of engagement by embracing cloud technologies. Now, by adopting Artificial intelligence and machine learning algorithms, we moved to a system of intelligence.

5. Further Enhancements

One can extend the research to bridge the blood donors, the hospitals, patients and the Doctors who treat patients. We could also witness for the same disease of patient record the treatment varies from Doctor to Doctor. It could be based on the nature of the patient also. Multiple healthcare plans are auditing the patient records to fix their next premium based on their health conditions and they also audit the doctor's treatment. If the audited information is used under machine learning algorithms we should be able to figure out the two important points 1). The Best Doctor who treats patients with appropriate diagnosis and treatment types, and choice of medicines as well. 2). The fraudulent Doctors who misuse the treatment pattern for different patients for the same disease. This study can be an interesting one and much more helpful for health plans to use these technologies. Right now they do audit the data, but it requires more workforce and lengthy process to conclude. Artificial Intelligence can use behavioural patterns of a Doctor based on their approach in the treatment and then we can even stop a doctor treating a patient who is not necessary. This way we can save time and money on health plan and also the individual patients. There are lots of studies done in the past and concluded that there is a fraudulent data, and that can be worked out. The countries like the USA spends more money on healthcare, and it demands a high level of monitoring and these technologies can help to find out the right person at the right time.

Acknowledgement

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