Problem Statement

The inability to move hearts from donor to recipient is the primary cause for an abysmal heart transplant rate in India. LifeBox tackles this problem with a system that extends preservation time of the heart to allow for increased travel time and distances.

Device Overview

LifeBox utilizes intermittent flushing of the heart with a preservation fluid to extend its out-of-body viable time. It has been designed to be portable, with corresponding innovations to overcome challenges of power and weight. Hypothermic temperatures (4 to 8 degree Celsius) are maintained using a novel patent-pending cooling system which uses a refrigerant, fans, and sensors for temperature regulation. This reduces the weight of the system by an order of magnitude as compared to traditional thermoelectric cooling methods. Additionally, the heart chamber is equipped with multiple sensors that continuously capture data, which serves as an indicator of heart health. This data allows the surgeon at the recipient site to take critical decisions, potentially leading to improved chances of success. Conceptually, the system can also be extended for preservation of other organs which rely on active flushing as a means of preservation.

My Contribution

As an Assistant Embedded Design Engineer at Indian Institute of Science, I independently managed a diverse set of responsibilities, including firmware architecture and design compatible with regulatory requirements, electronics and mechanical integration, digital and programmable component selection, touch display GUI design, and conducting risk analysis and FMEA. With no senior developer on the project at the time, with mentorship and guidance from professors and developers from other teams, I demonstrated initiative and technical proficiency to successfully deliver high-quality solutions across all aspects of embedded firmware development.

Medical Trial

During my tenure, a series of Animal Experiments were conducted in association with PSG hospital and collaboration with some of the reputed cardiac surgeons of India, which turned out to be successful to keep the heart viable for significantly longer than primitive ice boxes used for organ transport, with better biopsy results.

Awards and Accreditations

Note

Further details about the experiment or the device operation cannot be provided due to non-disclosure. Below are some images of the latest prototypes of the device.

Machine Design

User Interface Screen