Semiconductors for modern medicine

Implantable neurostimulators and health monitoring devices

Project introduction
New technological objective

• To create a device insertable via needle, without a surgery
• To eliminate necessity of implant replacement due to battery run-out

To achieve this challenging goal, capsule should be made using a specially designed chip.
Implantable capsule contains specially designed chip and antenna. Two opposite sides of a capsule are electrodes. Chip converts electromagnetic energy of radio-waves into electrical power (energy harvesting).
Battery-less implants: competition landscape

BlueWind (Israel) RENOVA iStim™ - clinical study stage

Capri Medical (Ireland) Luna-Air – prototype in 2021

StimWave (USA) – FDA cleared for some models

Endotronix (USA), St. Jude Medical (USA), Vectorious Medical (Israel) – Cordella implantable sensor

A bunch of companies worldwide started R&D on the subject, but only few achieved clinical results so far. Competition pace continues, major stakeholders are USA, Israel, Western Europe, China
ASSP (Application Specific Standard Product) instead Custom Product

ASSP Proposed solution – VOLTAI, an universal tool board platform for use in design of implantable neurostimulation devices and/or sensors for custom applications

Target Customers (Users)

- Medical-engineering companies
- Medical researchers / scientists
- Start-ups
- Medical centers
VOLTAI TOOL BOARD (PLATFORM) Key Innovations

• Based on a specialized microchip with all the necessary functions:
  - power supply;
  - neurostimulation;
  - wireless collection;
• Miniature size and smallest weight;
• Minimally invasive;
• Battery less or battery power supply;
• Support of wide range sensors;
• A choice of necessary options;
• Combine with other implanted devices
Both in PNS & CNS system:
- treat a wide range of neurological disorders;
- control of separate nerves;
- changing the stimulation parameters in the process;
- patient individual stimulation procedure

Possible to control an internal and external sensors (nerve potential sensor, temperature sensor, blood pressure sensor, pulse sensor, respiratory rate monitoring sensor, sensors for cardiovascular system indicators monitoring, blood glucose monitoring, blood oxygen levels monitoring etc.) as well as receive and process information from them.
VOLTAI CHIP

**Features**

- Build-in UHF RFID tag
- Battery-less solution
- Radio-wave power supply
- Up to 8 sensing facilities
- BLE Advertising on board
- Embedded RISC-V MCU
- Supply voltages:
  - Analog: ±9.0...18V, 5.0V
  - Digital core: 1.8V
  - Digital I/O: 3.3V

VOLTAI CHIP Simplified Diagram
Project stages

Stage 1
Design a new chip (by re-using existing IP blocks)
Make chip samples and capsule samples
Make a prototype of a control device
Create a basic software for stimulation tuning

Expected result:
Extensive implantable battery-less or with battery neurostimulation set – a complete toolkit for medical scientists to learn, test and clarify technical requirements for each particular application

Partnership:
Select a partner for future commercialization

Expenses:
USD 200K (NTLab’s own finances)

Timeline:
1..2 years

Stage 2
Collect feedback from medical scientists
Clarify technical requirements for each particular application
Create a linecard of capsules and control devices (by cutting unnecessary features of extensive prototype)
Arrange production
Apply for certification
Prepare for a clinical study

Expected result:
A linecard of capsules and control devices for medical market

Partnership:
Partner should cooperate with medical institutions and take care on certification/approvals

Expenses:
USD 2..5 mln (before clinical study)

Timeline:
2-3 years before a clinical study
Supply chain / value chain

Partner selection

NTLab responsibility in a project is a technical part – from specification to implementation, including manufacturing of a chip, capsule and control device.

Partner responsibilities:
- project funding
- cooperation with medical institutions to define stimulation parameters for each application
- product clinical testing and certification (using technical support from NTLab)
- product marketing and sales
THANKS FOR YOUR ATTENTION!

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