DEVICE FOR CONTROLLED HYPOTHERMIA ON FUZZY LOGIC ALGORITHMS

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Introduction

Therapeutic hypothermia is a non-pharmacological method that could improve neurological outcomes for multiple neurological pathologies as:

- uncontrolled intracranial hypertension;
- head trauma;
- ischemic vascular accidents.

Therapeutic hypothermia aims to decrease cerebral oxygen consumption (RMC 02 - cerebral metabolic rate of the oxygen) by lowering the body's temperature.

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Introduction

Depending on the decrease of the body temperature are known the following hypothermia levels:

A. normal thermal maintenance during the fever;

B. mild hypothermia (34 - 36 °C);

C. the average hypothermia (32 - 34 °C);

D. deep hypothermia (< 30 °C);

The A level is used for fever relief, in case isn't possible to use antipyretic therapy. B and C - are the most commonly used, being relatively safe in reducing body temperature.

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Methods

Invasive:

Heat transport is controlled by a catheter inserted into the femoral vein.

Noninvasive:

Using methods that are in direct contact with the patient's skin (covered with sheets soaked with water of applications with ice).

By using cooling devices which are using different cooling composites.

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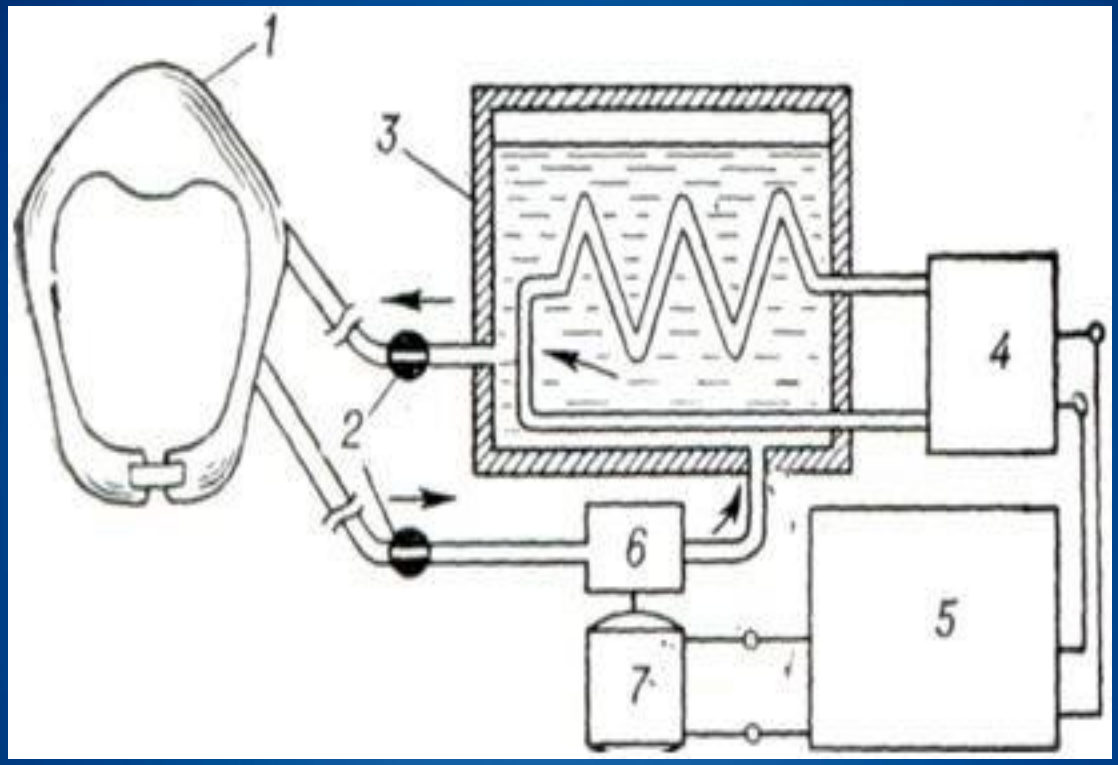
Methods



Холод 2ф device

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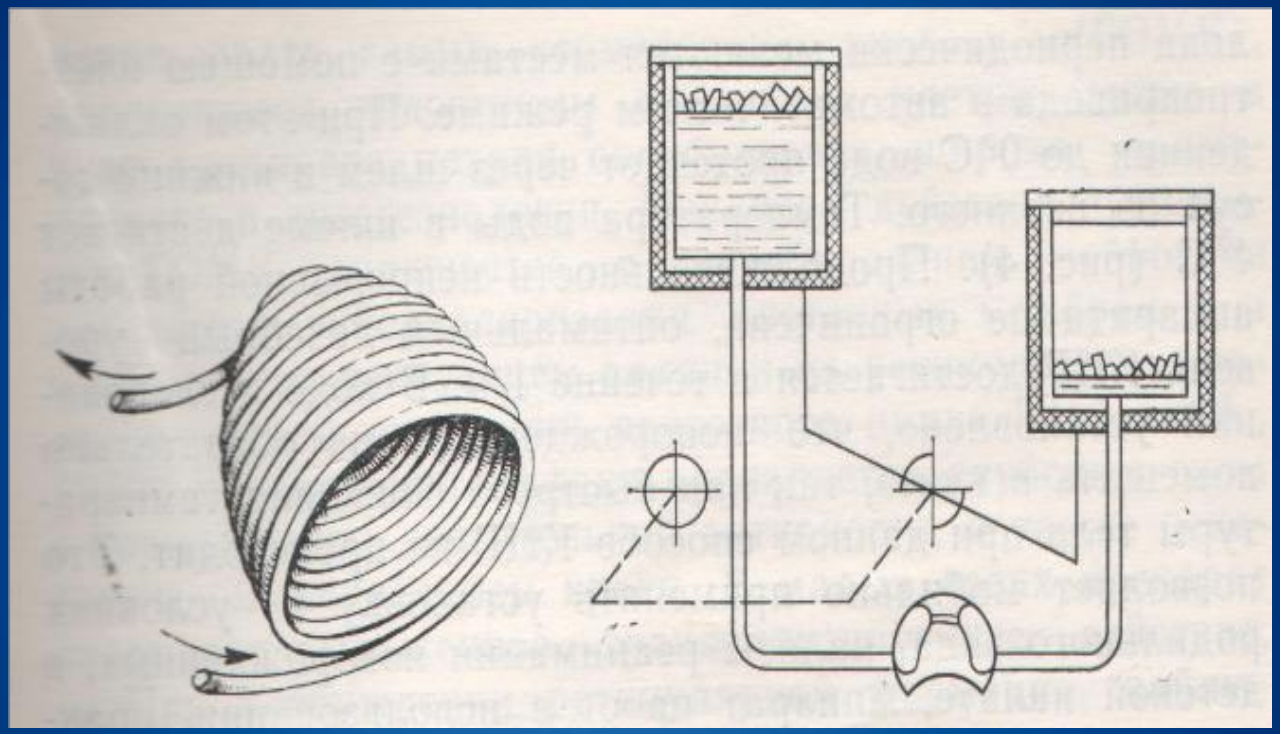
Methods



Device for therapeutic hypothermia at newborns

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Methods

Device for therapeutic hypothermia АТГ-01

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Goals

Building and testing a hypothermia device used in medicine for controlled cooling of woven in the skull.

To obtain a mobile device should be used small cooling elements of Peltier type which also allows the formation of directed independent cooling surfaces to obtain a nonuniform temperature area.

Leading cooling devices will be performed by fuzzy logic algorithms that enable intelligent temperature routing.

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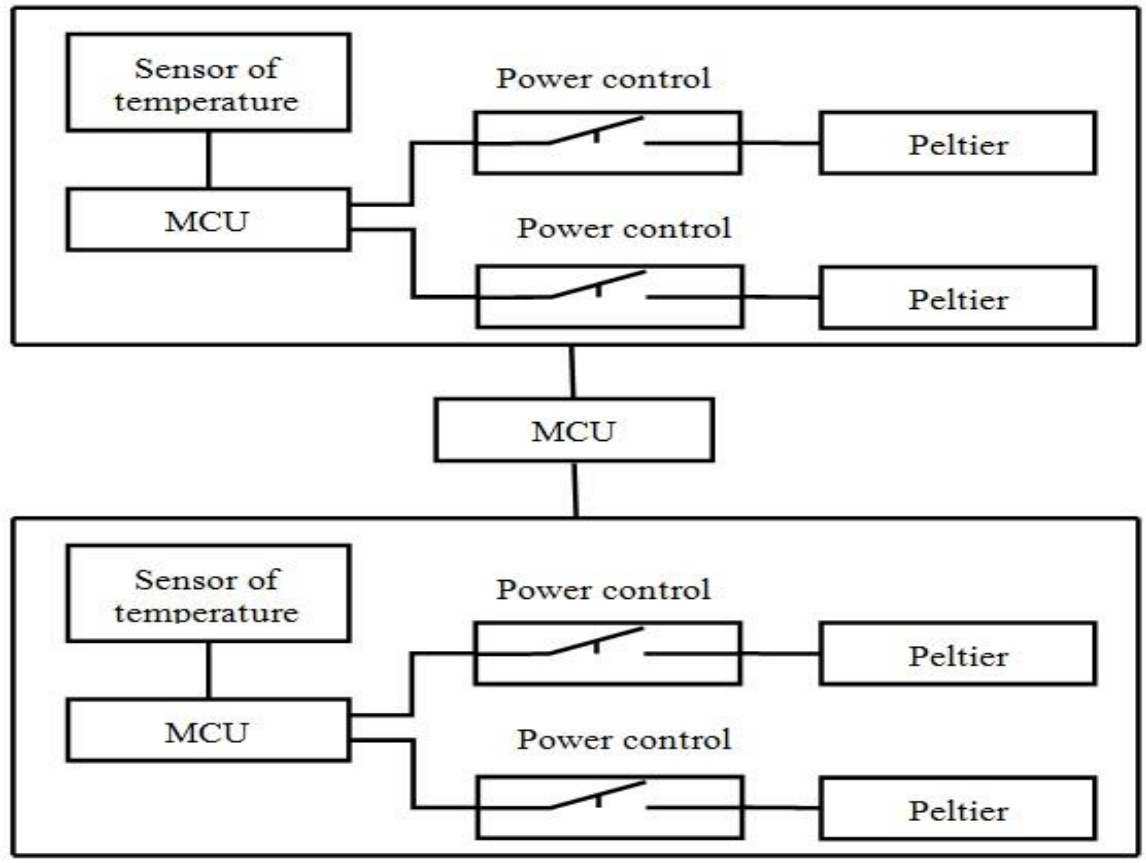
Circuit



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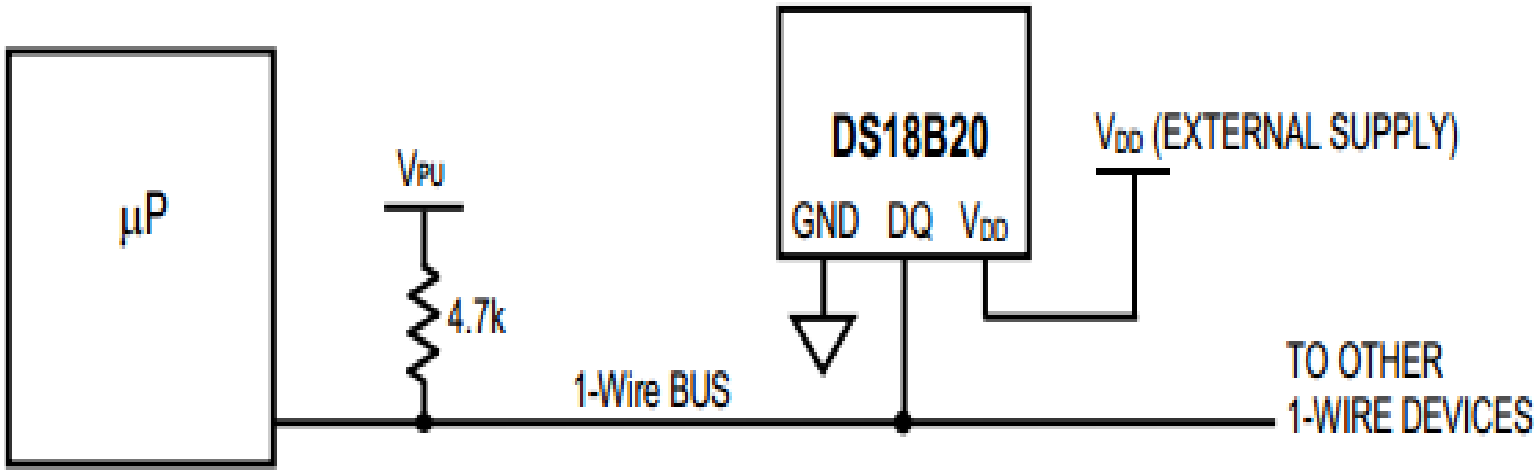
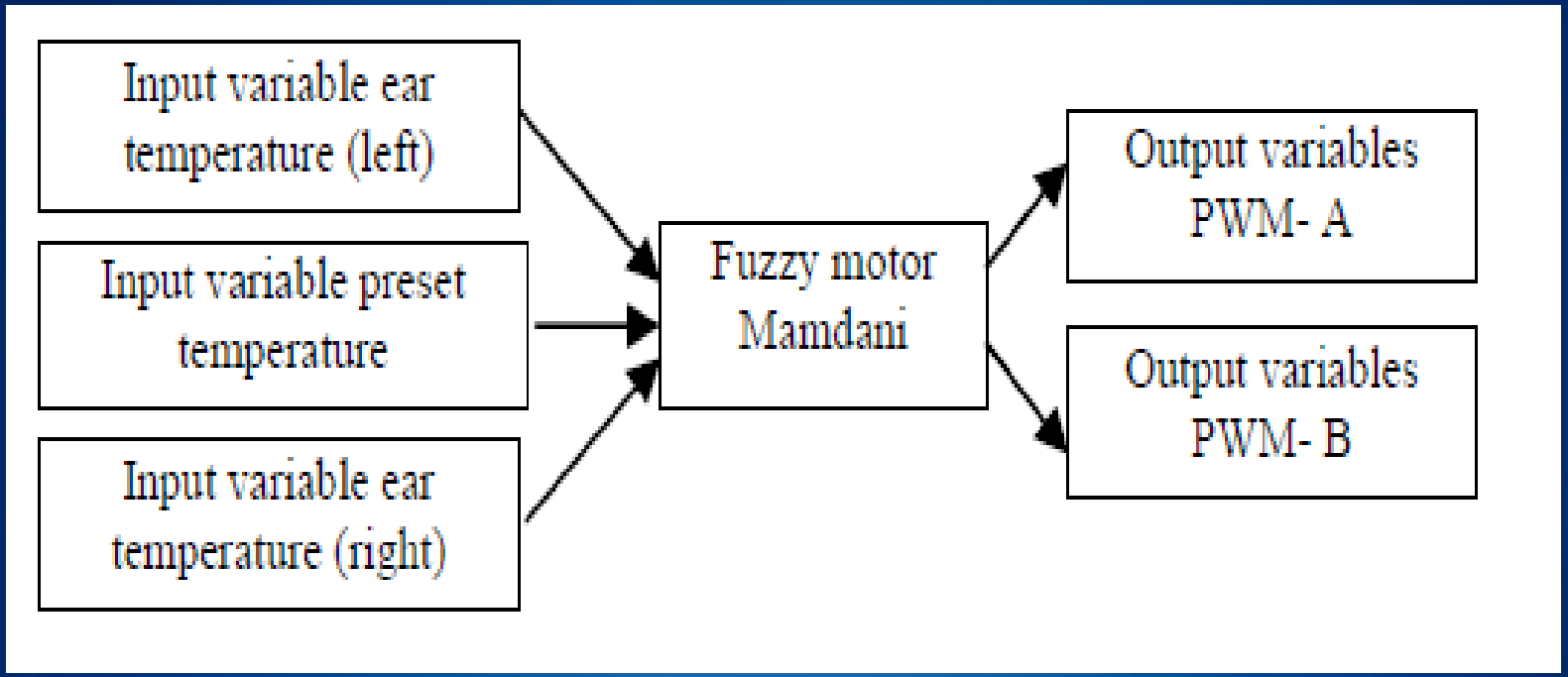
Circuit

Circuit



Fuzzy Logic



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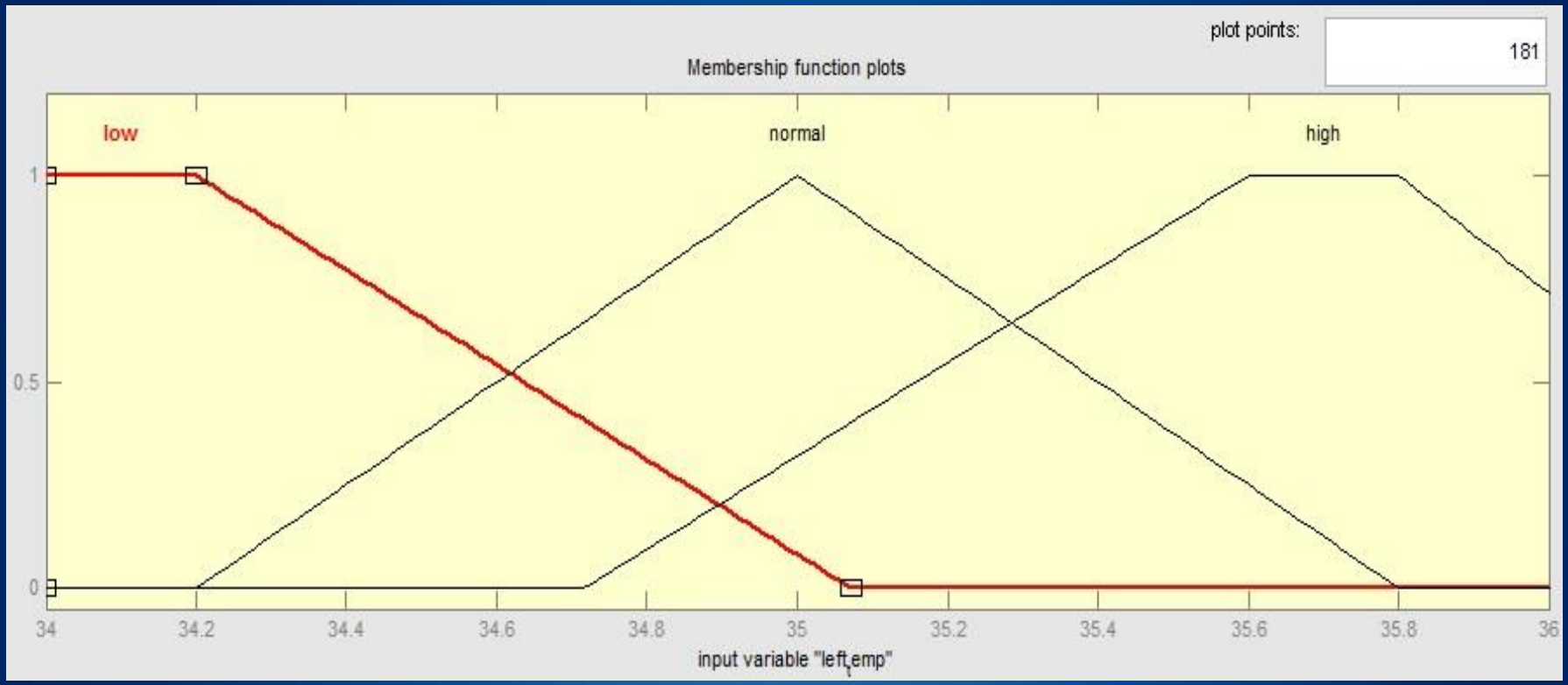
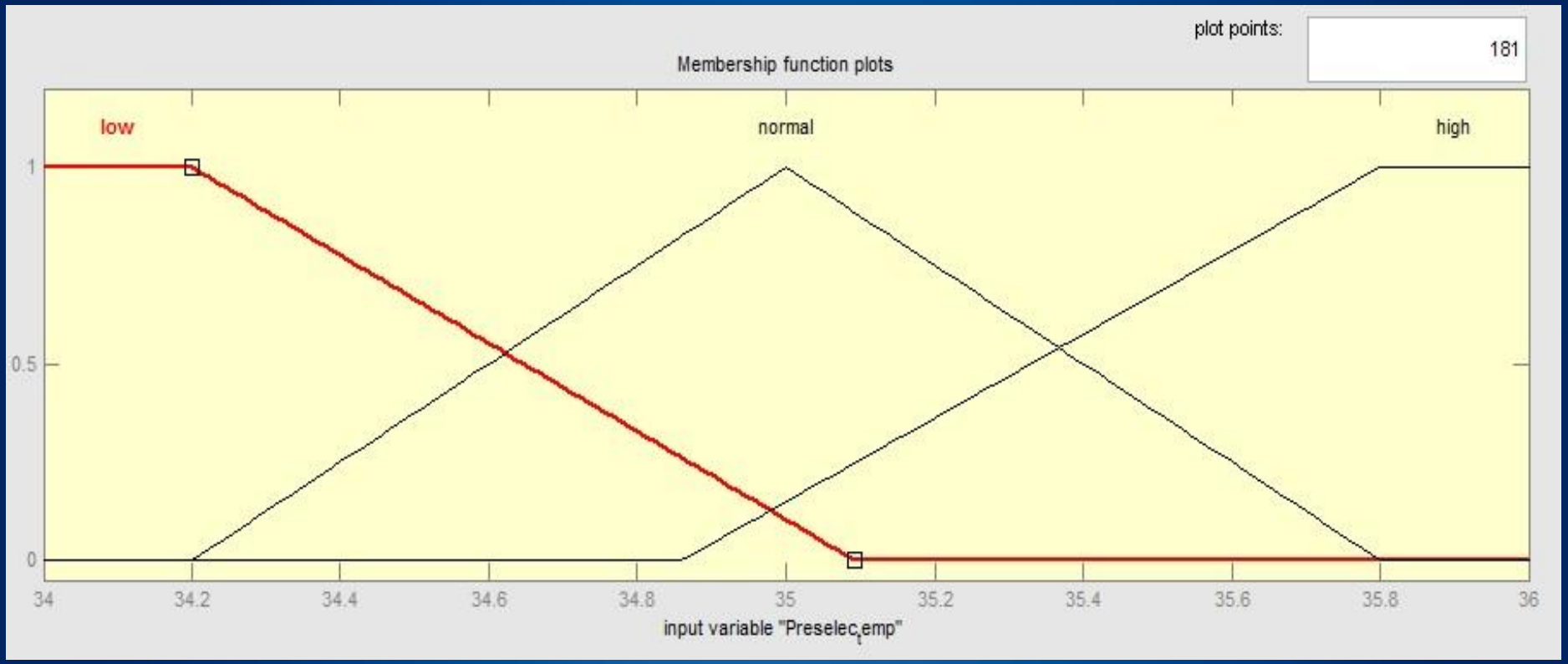
Fuzzy logic



Input variable “Ear temp. (left)”

Input variable “Ear temp. (right)”

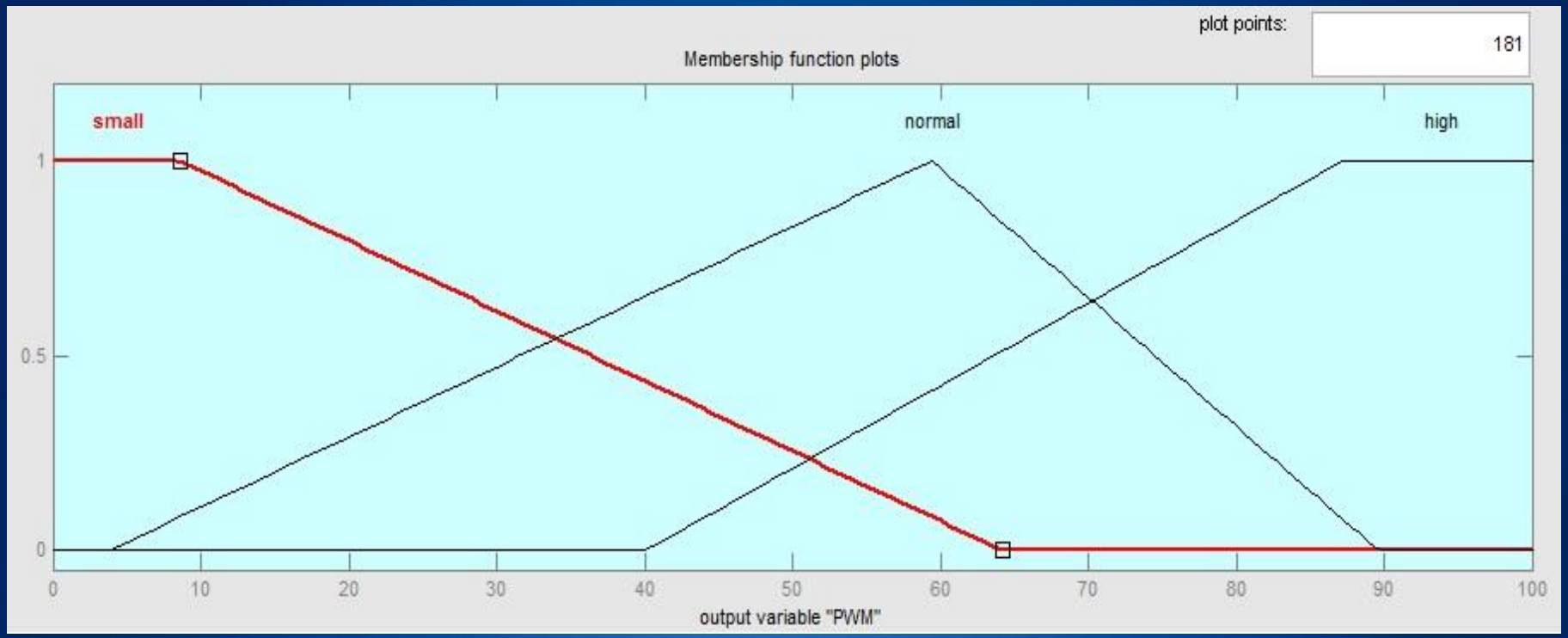
Fuzzy logic



Input variable “Preset temp”

Input variable “Ear temp. (right)”

Fuzzy logic



Output variable “PWM Peltier elements A”

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Rules set

- *If "Ear temp. (left)" is "low" and "Preset temperature is "normal" then "PWM A" is "small" and PWM B" is "normal*
- *If "Ear temp. (left)" is "low" and "Preset temperature" is "low" then "PWM A" is "small" and PWM B" is "small".*
- *"If "Ear temp. (left)" is "low" and "Preset temperature" is "high" then "PWM A" is "small" and PWM B" is ""high".*
- *If "Ear temp. (left)" is "normal" and "Preset temperature" is "low" then "PWM A" is "normal" and PWM B" is "small".*
- *If "Ear temp. (left)" is "normal" and "Preset temperature" is "normal" then "PWM A" is "normal" and PWM B" is "normal".*
- *If "Ear temp. (left)" is "normal" and "Preset temperature " is "high" then "PWM A" is "normal" and PWM B" is "high".*
- *If "Ear temp. (left)" is "high" and "Ear temp. (right)" is "low" then "PWM A" is "high" and PWM B" is "small".*
- *If "Ear temp. (left)" is "high" and "Preset temperature" is "normal" then "PWM A" is "high" and PWM B" is "normal".*
- *If "Ear temp. (left)" is "high" and "Preset temperature "is "high" then "PWM A" is "high" and PWM B" is "high".*

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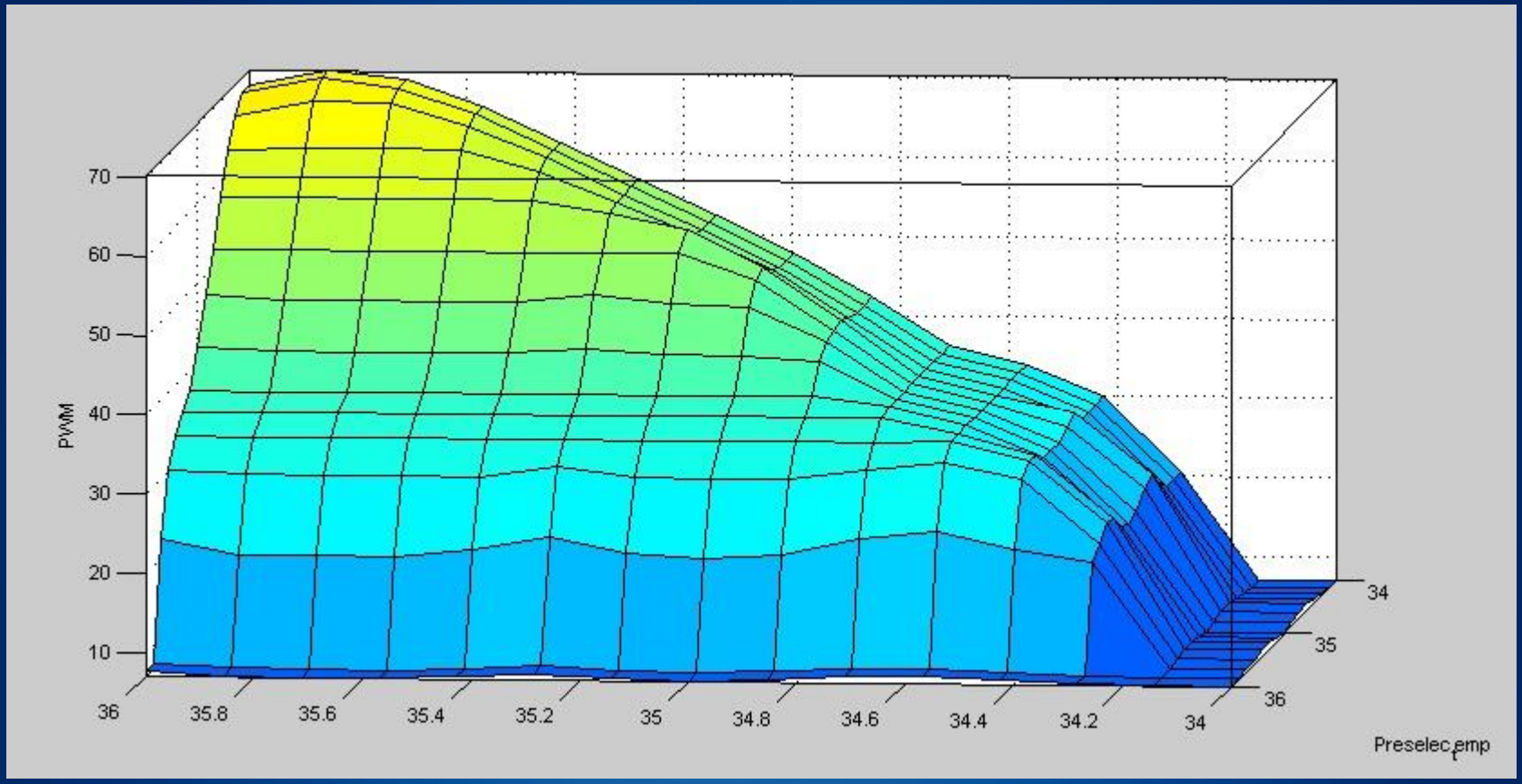
Fuzzy logic



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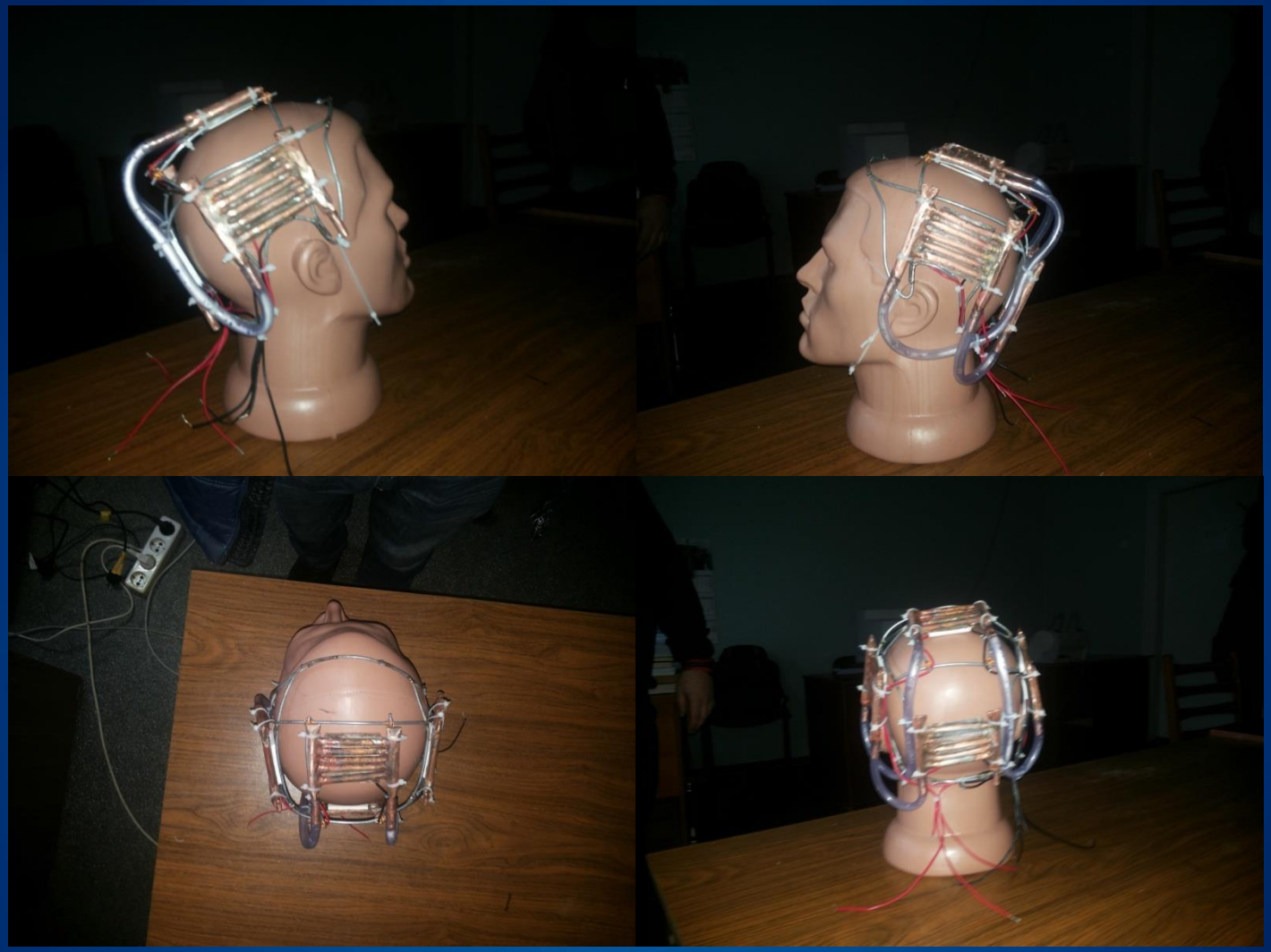

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Conclusions

- The authors constructed a sample of a device for therapeutic hypothermia used for controlled cooling of some woven using Peltier elements.
- Using Peltier cooling elements allow the development of a small mobile device that can be operated in emergency medical service, which also reduces the risk of ischemic tissue trauma after heart failure or blockage of the arteries at embolism.
- Routing algorithms will be made based on fuzzy rules which will be developed with physicians advisers in the field.

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