Human computer interface sa EOG-om

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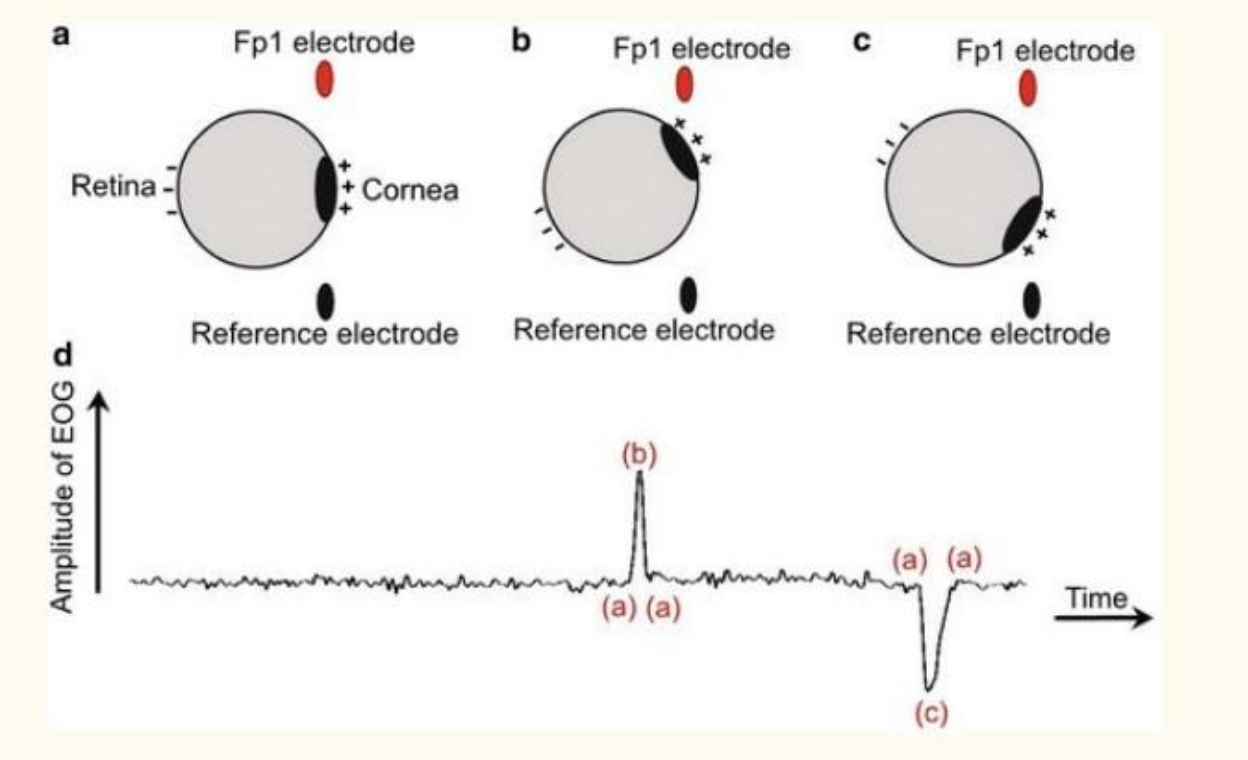
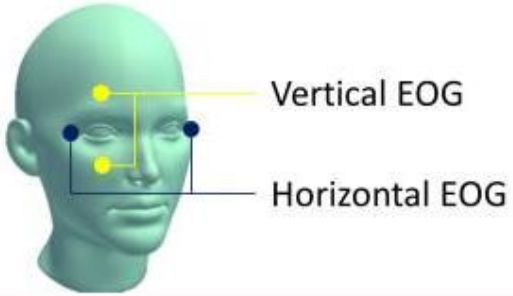
Elektrookulografija je tehnika detektovanja pokreta očiju na osnovu merenja potencijala između kornee (rožnjače) i retine(mrežnjače). Oko se može predstaviti električnim dipolom, gde je kornea (prednji deo) pozitivno, a retina (zadnji deo) negativno naelektrisana.



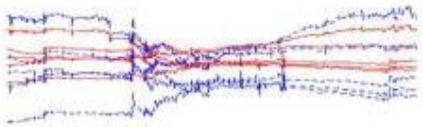
Signal acquisition

Signal processing

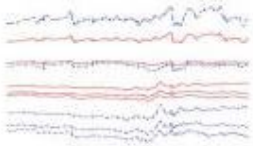
Application interface



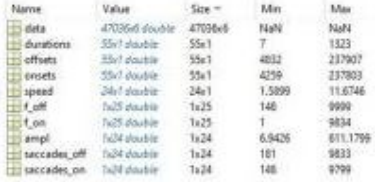
Amplification



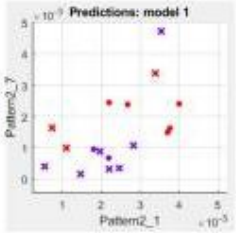
Pre-processing



Feature extraction



Classification



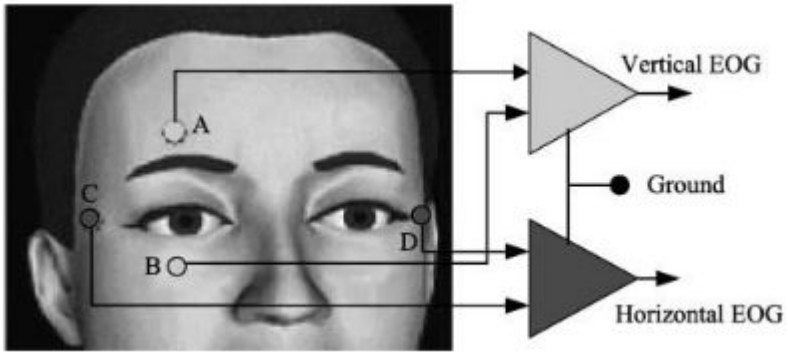
Pattern recognition

Application area HCI/BCI

Korišćena instrumentacija

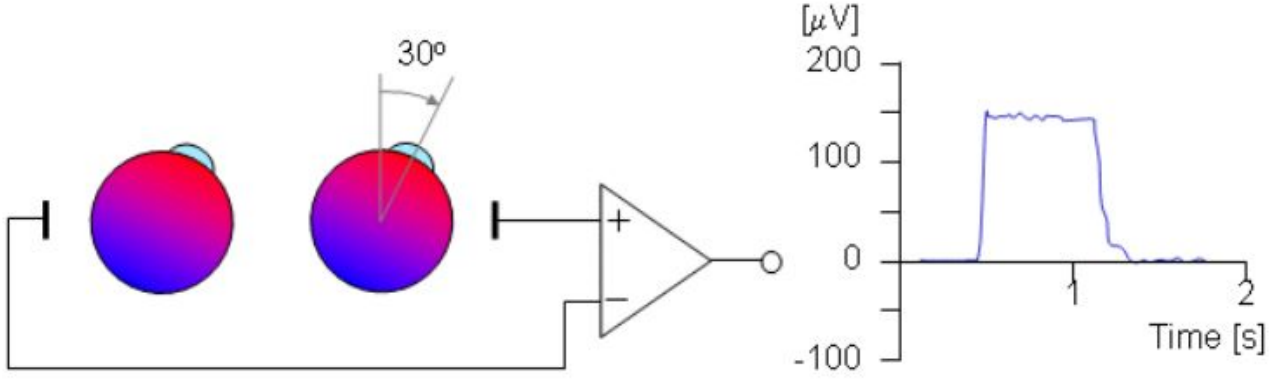
- EOG pojačavač (instrumentacioni pojačavači sa filterom propusnikom opsega)
- Laboratorijsko napajanje (-5V do +5V)
- Arduino
- Pet površinskih elektroda (za jednokratnu upotrebu)
- Python aplikacija za očitavanje, kalibraciju i kontrolu miša

Postavka elektroda

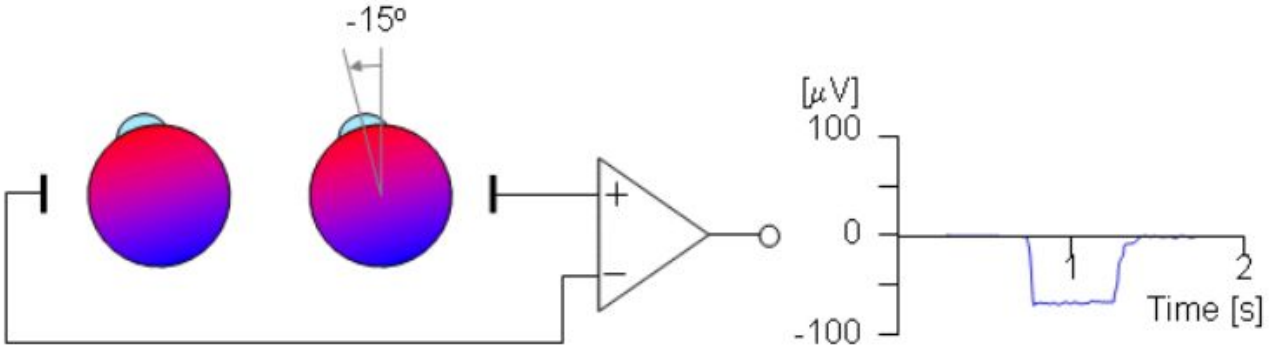


Jedan kanal za pokrete gore-dole i jedan za pokrete levo-desno, referentna elektroda na čelu.

Analiza signala

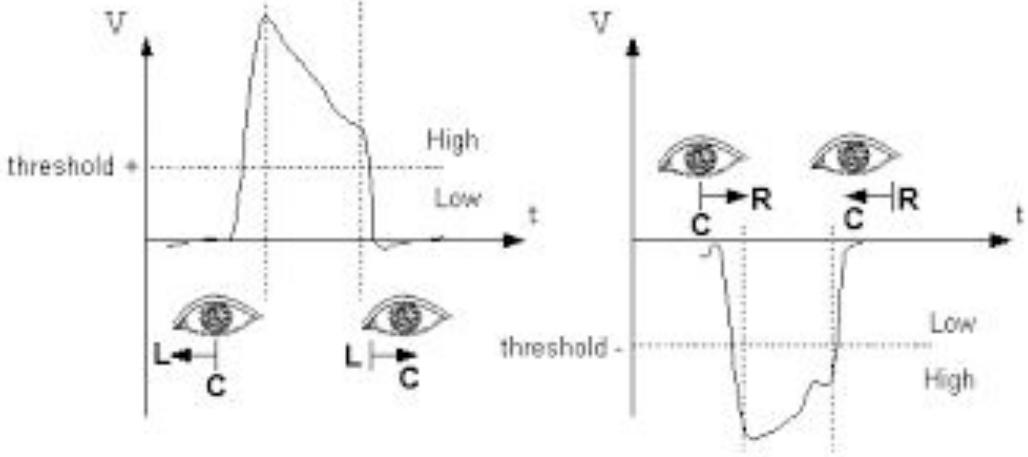


Eyes moving 30º to the right



Eyes moving 15º to the left

Klasifikacija pokreta oka



$$\text{classify}(\text{value})\begin{cases}\text{value} \geq \text{Amplitude}_{\text{Threshold}} \cdot \textit{Tolerance} \rightarrow \textit{High} \\ \text{value} < \text{Amplitude}_{\text{Threshold}} \cdot \textit{Tolerance} \rightarrow \textit{Low}\end{cases}$$

Kontrola miša pomoću EOG-a

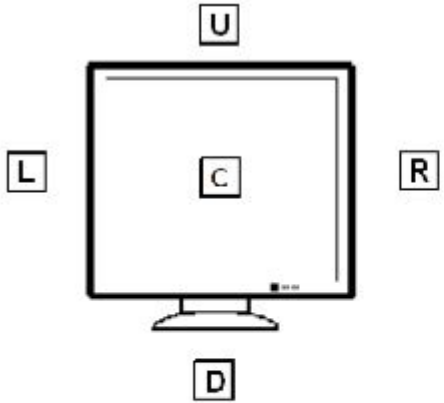
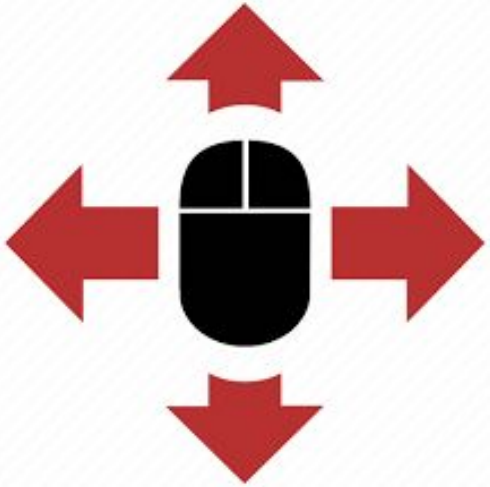
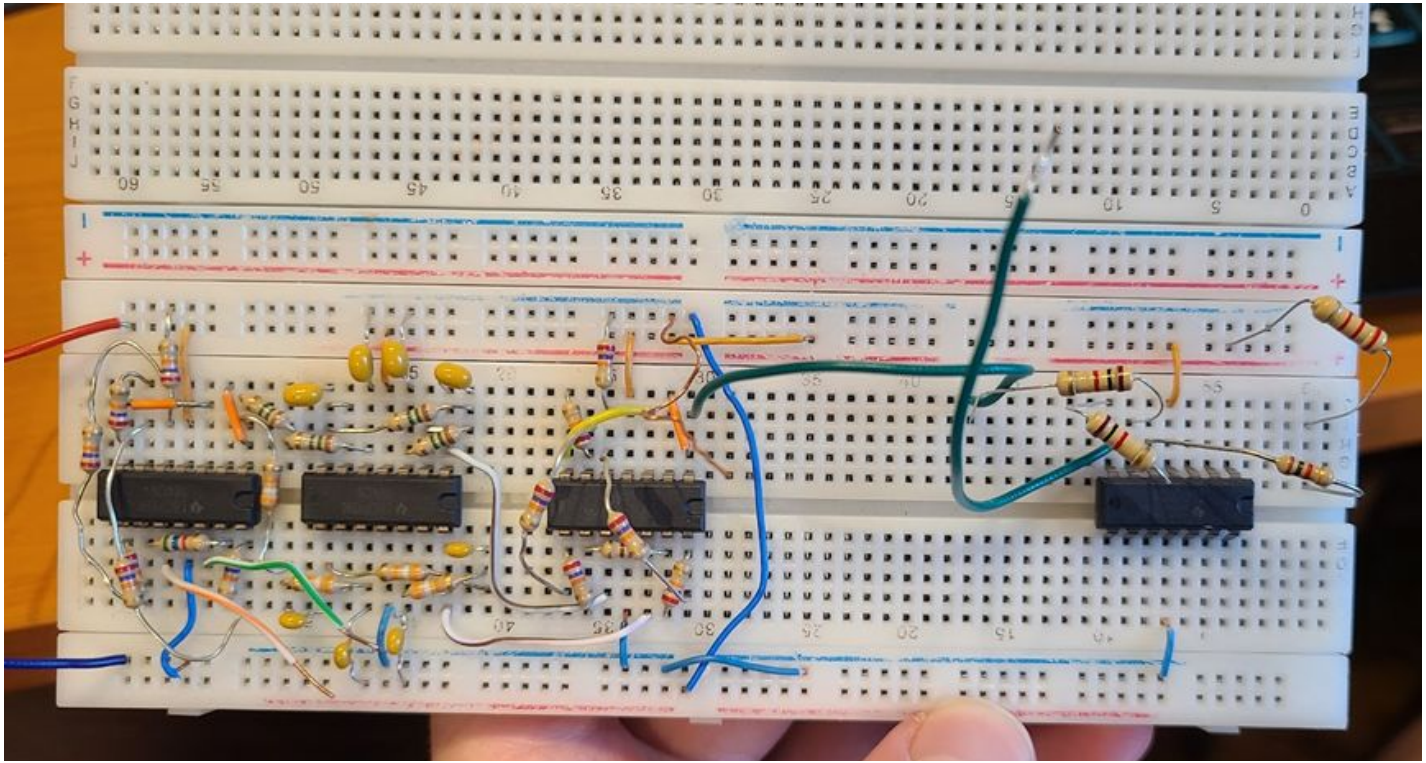


Figure 16. Targets of eyes movements.

Figure 17. Eye movements.

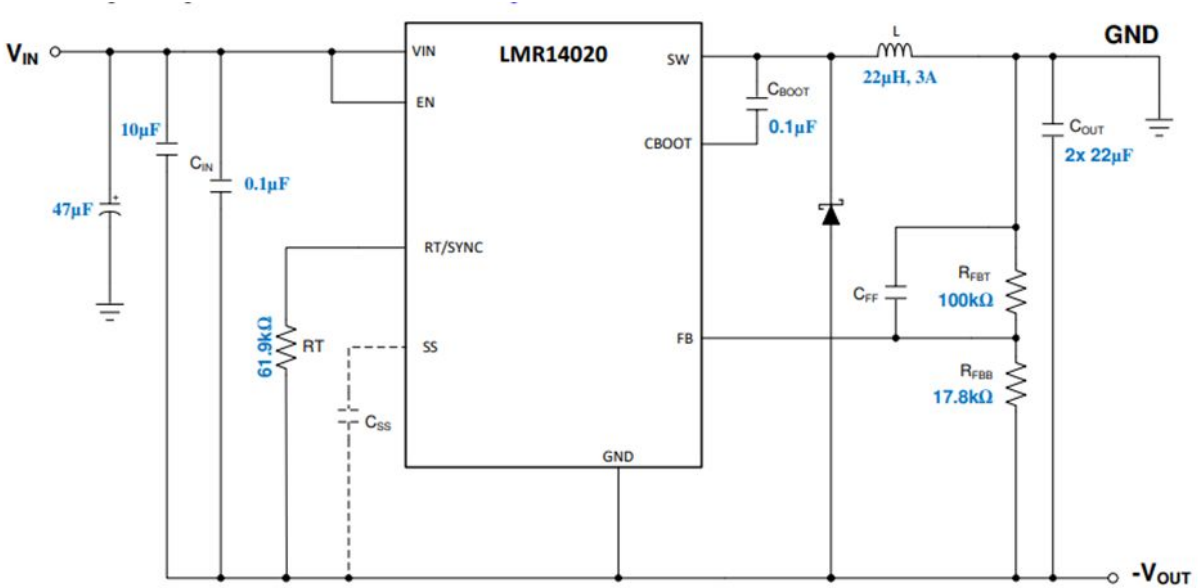


Hardver prototip



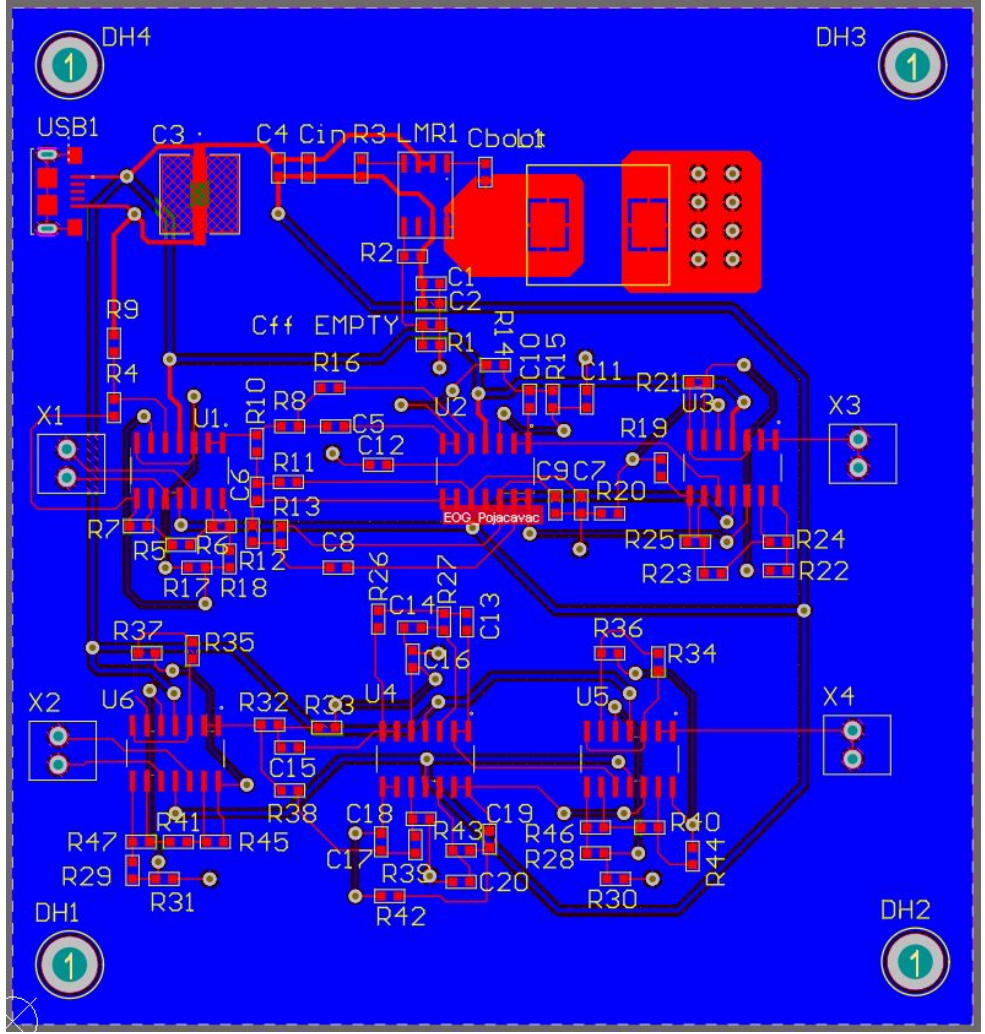
Novi zahtevi

- Manji šum
- Bolji kontakti
- Negativni napon napajanja

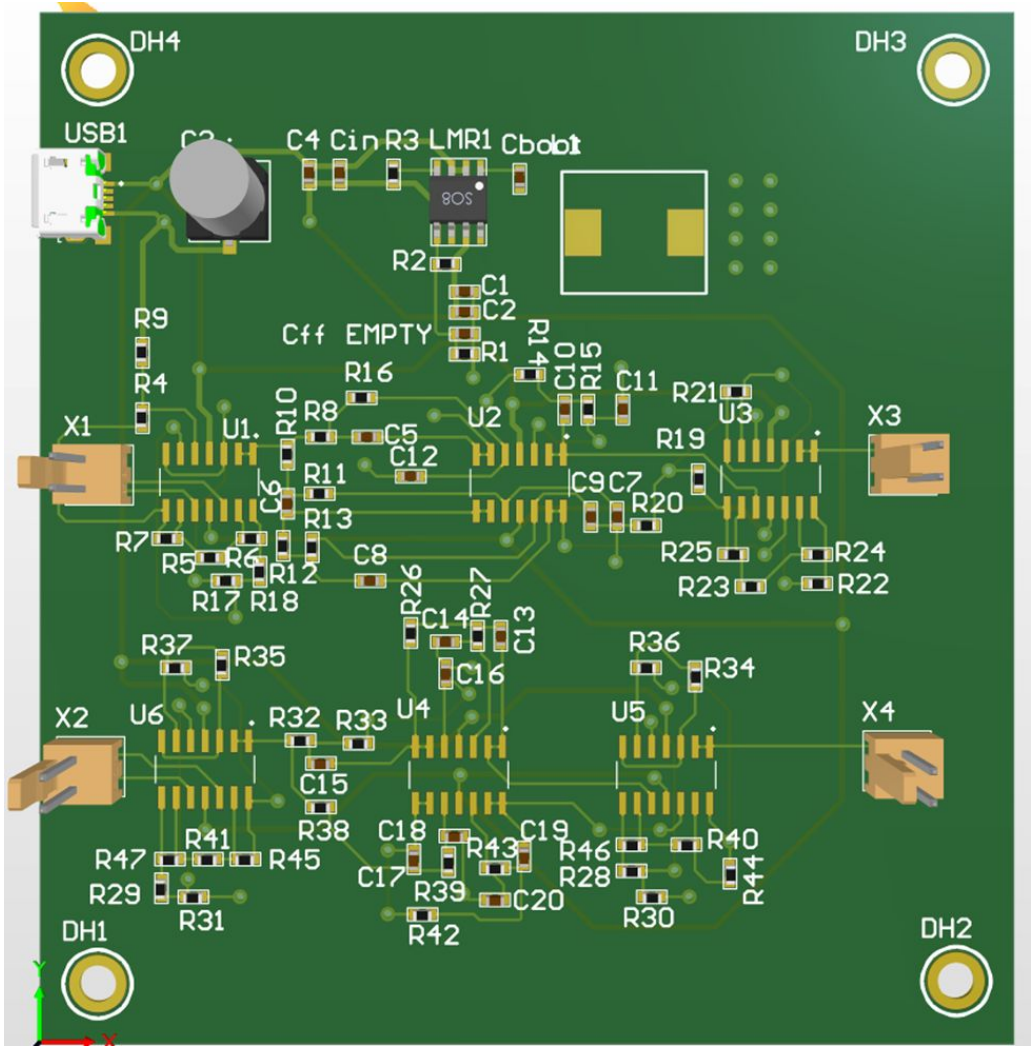


PCB 2D model

- 2 sloja
- SMD komponente
- Buck boost



3D model


DH4
DH3
USB1
C4
Cin
R3
LMR1
Cbobt
R2
C1
C2
R9
Cff
EMPTY
R1
R14
C10
R15
C11
R21
R4
R16
R10
R8
C5
U2
U3
X3
X1
U1.
C12
R19
R11
C9
C7
C6
R20
R13
R7
R5
R6
R12
C8
R25
R24
R23
R22
R17
R18
R26
R27
C14
C13
R37
R35
C16
R36
R34
X2
U6
R32
R33
U4
U5
X4
C15
R38
C18
C19
R41
R43
R46
R40
R47
R45
C17
R28
R44
R29
R31
R39
C20
R30
R42
DH1
DH2