# Abstract

A Body Area Network (BAN) is a collection of sensors placed around or in a human body to collect data like ECG, EMG, Temperature, Blood Pressure, etc,. The data collected from the human body can be later transmitted to remote stations. Typical BAN is a very small-scale network, in which wireless communication between the sensors and the control unit (often called as BAN coordinator) takes place at a distance of a few meters. BAN is one of the upcoming technologies that stand to the base for vast deployment of wearable and implantable sensors and it plays an important role on timely basis to monitor health of patients under various environmental conditions with a robustness of reliability and security. IEEE 802.15.6 standard formulates the specifications and design aspects of physical and medium access control layers of the BAN. In BAN, there could be various applications that would demand low latency, low packet error rate, low energy consumption etc. as well as continuous health monitoring in real time. This Master's Thesis focuses on the performance evaluation of IEEE 802.15.6 Standard.

The main goal is to understand the impact of security frames (i.e. various packet sizes) overhead on the latency and energy efficiency. The frame structure of IEEE 802.15.6 standard will be evaluated, the types of frames used in IEEE 802.15.6 standard are computed numerically in Matlab. First these calculations are obtained without considering the security frame overheads and then the security frame overheads are calculated and finally compared. It is observed that 1/3rd of the extra latency and energy consumption is required when security frames are introduced in the communication.

In addition, this work can be served as the starting point for the secured-BAN development in order to attain the performance imposed by BAN-based applications. This thesis is written in English and is 48 pages long, including 7 chapters, 15 figures and 19 tables.

# Annotatsioon

## Turvalised juhtmevabad kehavõrgud ja IEEE802.15.6 sidestandardi omaduste hindamine

Traadita kehavõrk (Body Area Network, BAN) on hulk liidestatud sensoreid, mis on paigutatud inimese kehale või kehasse, eesmärgiga koguda andmeid südametegevuse, lihastöö, kehatemperatuuri, vererõhu ja teiste sarnaste parameetrite kohta. Kogutud informatsiooni saab hiljem saata eemal asuvatesse seadmetesse. Tüüpiline BAN on pisivõrk, mille puhul juhtmevaba side kauguseks sensorite ja kekseadme (sageli nimetatud BAN koordinaatoriks) vahel on mõni meter. Kehavõrk on üks tuleviku baastehnoloogiatest, mis omab olulist rolli patsientide tervise pideval jälgimisel töökindlalt ja turvaliselt erinevates keskkonnatingimustes. IEEE802.15.6 standard sättestab BANi meediakihi (MAC layer) nõuded ja disainiaspektid. Kehavõrkude jaoks on erinevaid rakendusi, mis nõuavad madala hilistumise ja energiatarbega veavabasid lahendusi pidevaks reaalajaliseks jälgimiseks. Antud töö keskendub IEEE802.15.6 standardi omaduste hindamisele. Peamine eesmärk on mõista erineva suurusega turvapakettide lisandumise mõju andmevahetuse hilistumisele ja energiaefektiivsusele.

Analüüsitakse IEEE802.15.6 andmepakettide struktuuri; erinevad IEEE802.15.6 standardi paketid genereeritakse numbriliselt Matlabis. Esimesed arvutused teostatakse turvapakettide mõju arvestamata, siis hinnatakse turvapakettide tekitatud lisakoormust ja lõpuks võrreldakse tulemusi. Tulemuseks on, et turvapaketid põhjustavad 1/3 ulatuses täiendavat andmete hilistumist ja energiakulu. Lisaks, käesolevat tööd saab esitada alguspunktina turvalise kehavõrgu arendamiseks, et saavutada vajalik jõudlus BAN rakendustele.

Väitekiri on kirjutatud inglise keeles 48 leheküljel ning sisaldab 7 peatükki, 15 joonist ja 19 tabelit.