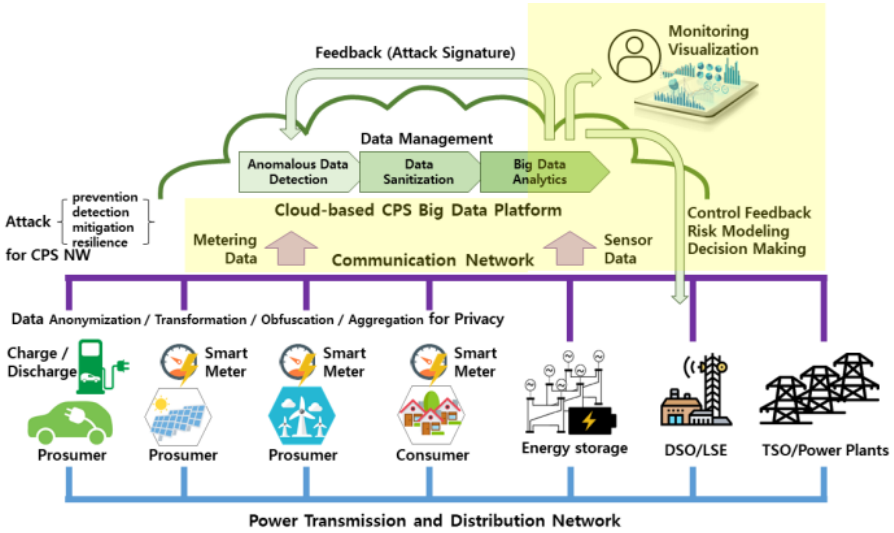
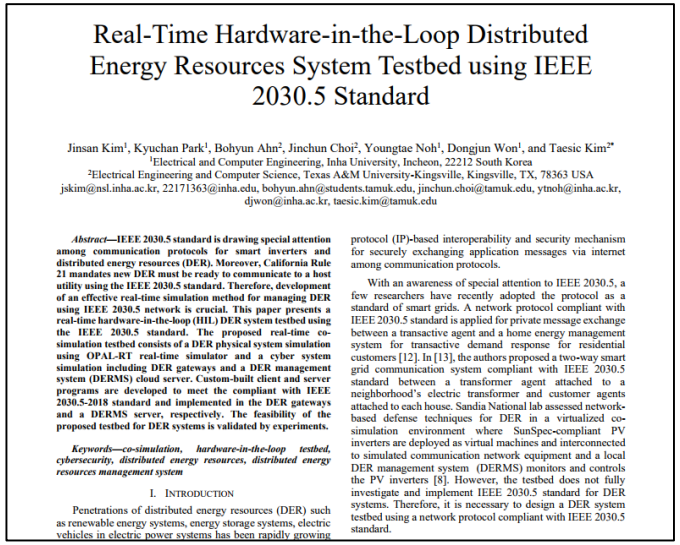
수행 프로젝트 1

프로젝트 명: 스마트 그리드의 클라우드 기반 빅데이터 플랫폼을 위한 사이버 보안 기술 개발



스마트 그리드 데이터를 위한 클라우드 기반
빅데이터 소프트웨어 플랫폼 구축



Real-Time Hardware-in-the-Loop Distributed Energy Resources System Testbed using IEEE 2030.5 Standard

Jinsan Kim[1], Kyuchan Park[1], Bohyun Ahn[2], Jinchun Choi[2], Youngtae Noh[1], Dongjun Won[1], and Taesic Kim[2*]
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***Abstract*—IEEE 2030.5 standard is drawing special attention among communication protocols for smart inverters and distributed energy resources (DER). Moreover, California Rule 21 mandates new DER must be ready to communicate to a host utility using the IEEE 2030.5 standard. Therefore, development of an effective real-time simulation method for managing DER using IEEE 2030.5 network is crucial. This paper presents a real-time hardware-in-the-loop (HIL) DER system testbed using the IEEE 2030.5 standard. The proposed real-time co-simulation testbed consists of a DER physical system simulation using OPAL-RT real-time simulator and a cyber system simulation including DER gateways and a DER management system (DERMS) cloud server. Custom-built client and server programs are developed to meet the compliant with IEEE 2030.5-2018 standard and implemented in the DER gateways and a DERMS server, respectively. The feasibility of the proposed testbed for DER systems is validated by experiments.**

Keywords—co-simulation, hardware-in-the-loop testbed, cybersecurity, distributed energy resources, distributed energy resources management system

I. INTRODUCTION

Penetrations of distributed energy resources (DER) such as renewable energy systems, energy storage systems, electric vehicles in electric power systems has been rapidly growing

protocol (IP)-based interoperability and security mechanism for securely exchanging application messages via internet among communication protocols.

With an awareness of special attention to IEEE 2030.5, a few researchers have recently adopted the protocol as a standard of smart grids. A network protocol compliant with IEEE 2030.5 standard is applied for private message exchange between a transactive agent and a home energy management system for transactive demand response for residential customers [12]. In [13], the authors proposed a two-way smart grid communication system compliant with IEEE 2030.5 standard between a transformer agent attached to a neighborhood's electric transformer and customer agents attached to each house. Sandia National lab assessed network-based defense techniques for DER in a virtualized co-simulation environment where SunSpec-compliant PV inverters are deployed as virtual machines and interconnected to simulated communication network equipment and a local DER management system (DERMS) monitors and controls the PV inverters [8]. However, the testbed does not fully investigate and implement IEEE 2030.5 standard for DER systems. Therefore, it is necessary to design a DER system testbed using a network protocol compliant with IEEE 2030.5 standard.

IEEE PES IGST Asia 2021 투고
(결과 발표: 9/30)

사용 기술 스택

ubuntu

APACHE HTTP SERVER

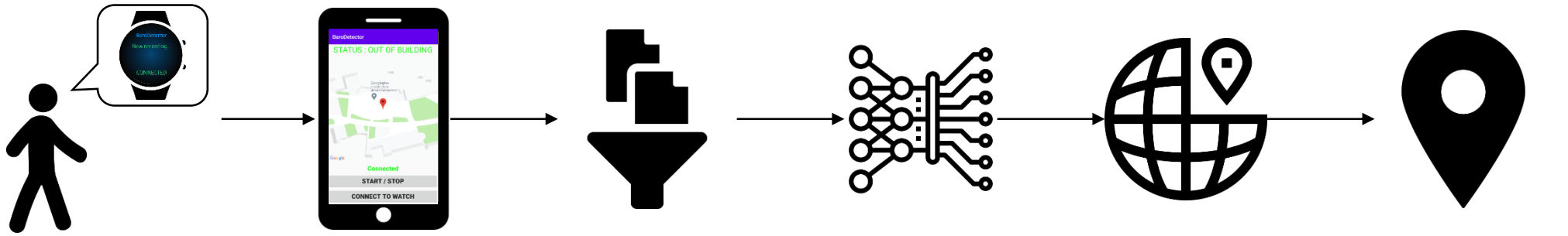
django REST framework

linode

TLS 1.3

수행 프로젝트 2

프로젝트 명: 스마트워치 기압계를 활용한 건물 단위 위치 추적



사용자 기압 데이터 수집 → 기압 데이터 수신 → 데이터 전처리 → 기계학습(WEKA) 이용, 건물 출입 여부 판단 → GPS visible satellite 개수 확인 Threshold: 6 → 건물에 들어간 경우: GPS block 들어가지 않은 경우: ignore

사용 기술 스택

android TIZEN™

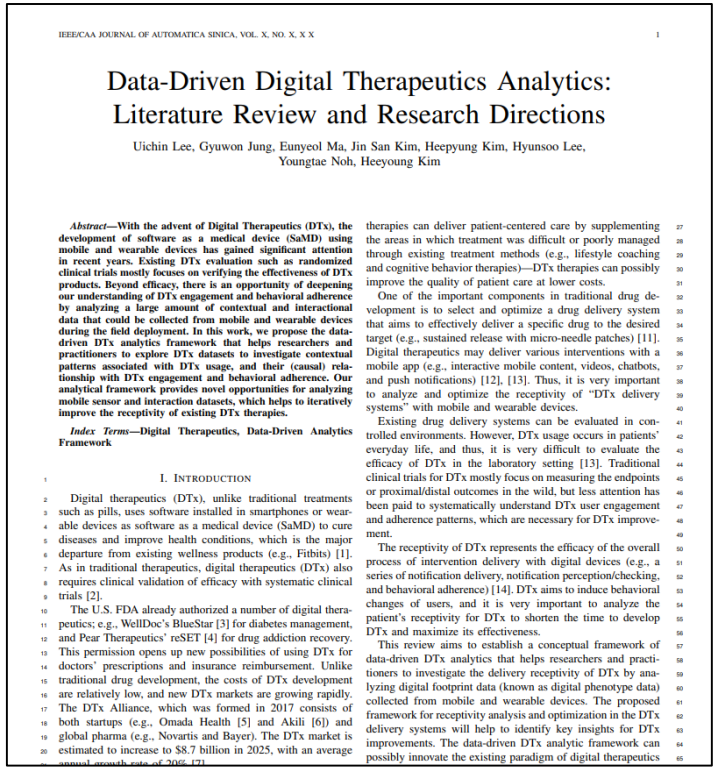
한국통신학회 Journal 투고

수행 프로젝트 3

프로젝트 명: 모바일 치료제 개발을 위한 데이터 기반 치료제 전달 수용도 최적화 원천 기술 개발

디지털 치료제 (DTx: Digital Therapeutics)

질병이나 장애를 예방, 관리, 치료하기 위한 근거 기반(evidence-based)의 치료적중재를 제공하는 의료기기로서의 소프트웨어(SaMD: Software as a Medical Device)



IEEE/CAA JOURNAL OF AUTOMATICA SINICA, VOL. X, NO. X, X X

Data-Driven Digital Therapeutics Analytics: Literature Review and Research Directions

Uichin Lee, Gyuwon Jung, Eunyeol Ma, Jin San Kim, Heepyung Kim, Hyunsoo Lee, Youngtae Noh, Heeyoung Kim

Abstract—**With the advent of Digital Therapeutics (DTx), the development of software as a medical device (SaMD) using mobile and wearable devices has gained significant attention in recent years. Existing DTx evaluation such as randomized clinical trials mostly focuses on verifying the effectiveness of DTx products. Beyond efficacy, there is an opportunity of deepening our understanding of DTx engagement and behavioral adherence by analyzing a large amount of contextual and interactional data that could be collected from mobile and wearable devices during the field deployment. In this work, we propose the data-driven DTx analytics framework that helps researchers and practitioners to explore DTx datasets to investigate contextual patterns associated with DTx usage, and their (causal) relationship with DTx engagement and behavioral adherence. Our analytical framework provides novel opportunities for analyzing mobile sensor and interaction datasets, which helps to iteratively improve the receptivity of existing DTx therapies.**

Index Terms—**Digital Therapeutics, Data-Driven Analytics Framework**

I. Introduction

Digital therapeutics (DTx), unlike traditional treatments such as pills, uses software installed in smartphones or wearable devices as software as a medical device (SaMD) to cure diseases and improve health conditions, which is the major departure from existing wellness products (e.g., Fitbits) [1]. As in traditional therapeutics, digital therapeutics (DTx) also requires clinical validation of efficacy with systematic clinical trials [2].

The U.S. FDA already authorized a number of digital therapeutics; e.g., WellDoc's BlueStar [3] for diabetes management, and Pear Therapeutics' reSET [4] for drug addiction recovery. This permission opens up new possibilities of using DTx for doctors' prescriptions and insurance reimbursement. Unlike traditional drug development, the costs of DTx development are relatively low, and new DTx markets are growing rapidly. The DTx Alliance, which was formed in 2017 consists of both startups (e.g., Omada Health [5] and Akili [6]) and global pharma (e.g., Novartis and Bayer). The DTx market is estimated to increase to $8.7 billion in 2025, with an average annual growth rate of 20% [7].

therapies can deliver patient-centered care by supplementing the areas in which treatment was difficult or poorly managed through existing treatment methods (e.g., lifestyle coaching and cognitive behavior therapies)—DTx therapies can possibly improve the quality of patient care at lower costs.

One of the important components in traditional drug development is to select and optimize a drug delivery system that aims to effectively deliver a specific drug to the desired target (e.g., sustained release with micro-needle patches) [11]. Digital therapeutics may deliver various interventions with a mobile app (e.g., interactive mobile content, videos, chatbots, and push notifications) [12], [13]. Thus, it is very important to analyze and optimize the receptivity of "DTx delivery systems" with mobile and wearable devices.

Existing drug delivery systems can be evaluated in controlled environments. However, DTx usage occurs in patients' everyday life, and thus, it is very difficult to evaluate the efficacy of DTx in the laboratory setting [13]. Traditional clinical trials for DTx mostly focus on measuring the endpoints or proximal/distal outcomes in the wild, but less attention has been paid to systematically understand DTx user engagement and adherence patterns, which are necessary for DTx improvement.

The receptivity of DTx represents the efficacy of the overall process of intervention delivery with digital devices (e.g., a series of notification delivery, notification perception/checking, and behavioral adherence) [14]. DTx aims to induce behavioral changes of users, and it is very important to analyze the patient's receptivity for DTx to shorten the time to develop DTx and maximize its effectiveness.

This review aims to establish a conceptual framework of data-driven DTx analytics that helps researchers and practitioners to investigate the delivery receptivity of DTx by analyzing digital footprint data (known as digital phenotype data) collected from mobile and wearable devices. The proposed framework for receptivity analysis and optimization in the DTx delivery systems will help to identify key insights for DTx improvements. The data-driven DTx analytic framework can possibly innovate the existing paradigm of digital therapeutics

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Peer-review 후 revision 완료

연구 목표: 모바일 및 웨어러블 환경에 특화된 데이터 기반 DTx 전달 수용도 프레임워크 개발

참여 논문 및 특허, 수상경력

참여 논문

1. An Advanced Persistent Threat (APT)-Style Cyberattack Testbed for Distributed Energy Resources (DER) – 3저자 (IEEE DMC 2021)

참여 특허

건물 단위 정밀도 위치 정보 시스템 – 등록
LOF 기반 노인배회 및 미아방지 시스템 – 출원


특허증
CERTIFICATE OF PATENT

특 허 제 10-2102635 호
Patent Number

출원번호 제 10-2018-0172047 호
Application Number

출원일 2018년 12월 28일
Filing Date

등록일 2020년 04월 14일
Registration Date

발명의명칭 Title of the Invention
에어타임을 고려한 사용자 연결제어 개선 방법 및 시스템

특허권자 Patentee
인하대학교 산학협력단(120171-*******)
인천광역시 미추홀구 인하로 100(용현동, 인하대학교)

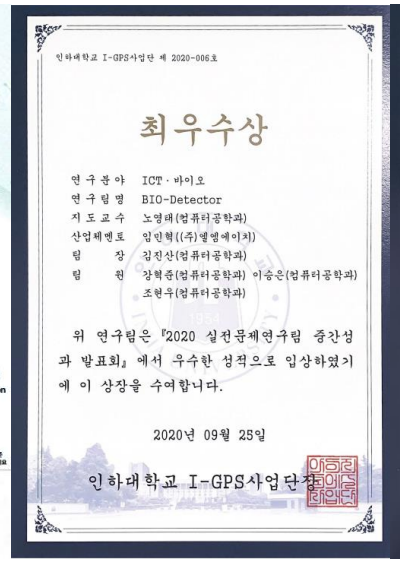
발명자 Inventor
등록사항란에 기재

위의 발명은 「특허법」에 따라 특허등록원부에 등록되었음을 증명합니다.
This is to certify that, in accordance with the Patent Act, a patent for the invention has been registered at the Korean Intellectual Property Office.

2020년 04월 14일

특허청장
COMMISSIONER,
KOREAN INTELLECTUAL PROPERTY OFFICE
박 원주

특허청
Korean Intellectual Property Office


인하대학교 I-GPS사업단 제 2020-006호

최우수상

연 구 분 야 ICT · 바이오
연 구 팀 명 BIO-Detector
지 도 교 수 노영태(컴퓨터공학과)
산업체멘토 임민혁((주)엘엠에이치)
팀 장 김진산(컴퓨터공학과)
팀 원 강혁준(컴퓨터공학과) 이승은(컴퓨터공학과)
조현우(컴퓨터공학과)

위 연구팀은 『2020 실전문제연구팀 중간성과 발표회』에서 우수한 성적으로 입상하였기에 이 상장을 수여합니다.

2020년 09월 25일

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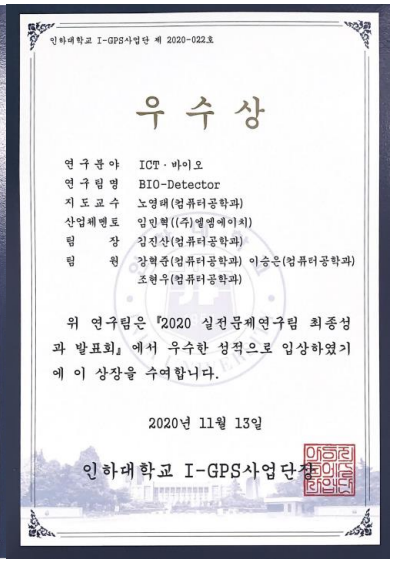
인하대학교 I-GPS사업단 제 2020-022호

우 수 상

연 구 분 야 ICT · 바이오
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조현우(컴퓨터공학과)

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2020년 11월 13일

인하대학교 I-GPS사업단장

수상 내역

2020 실전문제연구팀 중간 성과 발표회 최우수상
2020 실전문제연구팀 최종 성과 발표회 우수상

Github

https://github.com/Jinsan-Dev