# 연구실 소개



## 인하대학교 지능형 모바일 컴퓨팅 연구실 (구 네트워크 시스템 연구실)

지도 교수: 노영태

인하대학교 컴퓨터공학과 부교수

Purdue University as a Postdoctoral Research Associate. (2015)

Cisco Systems as a software engineer. (2012–2014)

Ph.D. in computer science at University of California, Los Angeles (UCLA). 2012

#### 연구 분야

Human-Computer Interaction (HCI): 스마트폰/워치 등 모바일 기기로부터 센서 데이터를 수집해, 인공지능 기술에 접목함으로써 일상생활의 문제를 해결하고자 함. 최근에는 사용자의 센서데이터 및 스마트폰 이용 데이터 (특정 어플 사용 시간 등)을 이용해 사용자의 우울 수준을 탐지하는 등의 디지털 치료제 (Digital Therapeutics) 관련 연구 진행중.

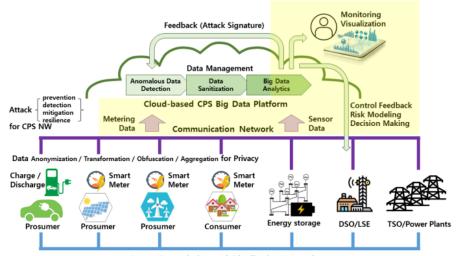
IoT Platform System 구축: 모바일 기기, 클라우드 서버, DB 등을 아우르는 IoT 플랫폼 시스템 구축.

빅데이터 프레임워크(e,g,. Hadoop, Spark) 분산 시스템 개선 및 구축

## 수행 프로젝트 1

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

Texas A&M Univ-Kingsville 파견 연구 (20.12~21.05)



Power Transmission and Distribution Network

스마트 그리드 데이터를 위한 클라우드 기반 빅데이터 소프트웨어 플랫폼 구축

사용 기술 스택

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

Jinsan Kim<sup>1</sup>, Kyuchan Park<sup>1</sup>, Bohyun Ahn<sup>2</sup>, Jinchun Choi<sup>2</sup>, Youngtae Noh<sup>1</sup>, Dongjun Won<sup>1</sup>, and Taesic Kim<sup>2</sup> 'Electrical and Computer Engineering, Inha University, Incheon, 22212 South Korea 'Electrical Engineering and Computer Science, Texas A&W University-Kingsville, Kingsville, TX, 78363 USA jskim@nsl.inha.ac.kr, 22171363@inha.edu, bohyun.ahm@students.tamuk.edu, jinchun.choi@tamuk.edu, yntoh@inha.ac.kr, discon@inba.ac.kr, ac.kr. discon@inba.ac.kr. texasic kindbamuk.edu

Abstract—IEEE 2030.5 standard is drawing special attention mong communication protocols for smart laweters and distributed energy resources (DEB). Moreover, California Rule 21 mandates now 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 lawaluter-in-the-loop (IIII.) DER system testled using the IEEE 2030.5. standard. The proposed real-time consultation testled consists of a DER physical system simulation stated consists of a DER physical system simulation system (DERSM) cloud server. Custom-built client and server programs are developed to meet the compliant with IEEE 2030.5-2018 standard and minimented in the DER gateways and a DERMS server, respectively. The feasibility of the proposed testled 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

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 managemen system for transactive demand response for residential customers [12]. In [13], the authors proposed a two-way smar 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 networkbased defense techniques for DER in a virtualized cosimulation 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

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



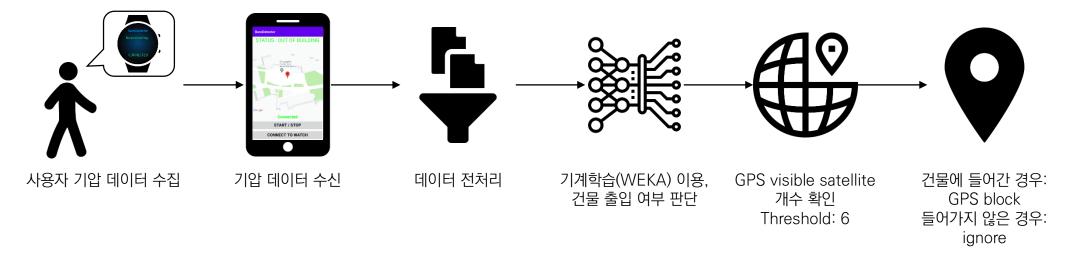






# 수행 프로젝트 2

## 프로젝트 명: 스마트워치 기압계를 활용한 건물 단위 위치 추적



사용 기술 스택



한국통신학회 투고용 양식

BaroDetector: 스마트워치를 이용한 건물 단위 위치 추적

(BaroDetector: Building Level Location Track using Smartwatch)

요 약

스러트워크 설립 모여성 전략기 가능하면 보는 보다 이 경우 설립 수 있는 경우 기 가능하는 보다 되지 하지 기 가능하는 보다 기 가

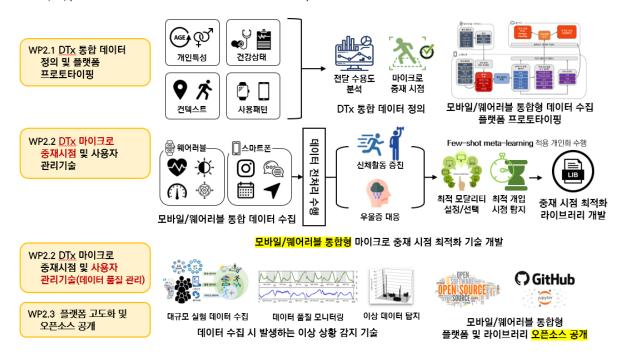
한국통신학회 Journal 투고

# 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 의료기기 로서의 소프트웨어(SaMD: Software as a Medical Device)



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

#### 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 therapies can deliver patient-centered care by supplementing development of software as a medical device (SaMD) using mobile and wearable devices has gained significant attention recent years. Existing DTx evaluation such as randomized products. Beyond efficacy, there is an opportunity of deepening during the field deployment. In this work, we propose the data natterns associated with DTv usage, and their (causal) relaonship with DTx engagement and behavioral adherence. Our nobile sensor and interaction datasets, which helps to iteratively improve the receptivity of existing DTx therapies.

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

Index Terms-Digital Therapeutics, Data-Driven Analytics

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 6 departure from existing wellness products (e.g., Fitbits) [1]. As in traditional theraneutics, digital theraneutics (DTx) also requires clinical validation of efficacy with systematic clinical trials [2]

peutics; e.g., WellDoc's BlueStar [3] for diabetes management, and Pear Therapeutics' reSET [4] for drug addiction recovery. 13 This permission opens up new possibilities of using DTx for doctors' prescriptions and insurance reimbursement. Unlike are relatively low, and new DTx markets are growing rapidly 17 The DTx Alliance, which was formed in 2017 consists of both startups (e.g., Omada Health [5] and Akili [6]) and 19 global pharma (e.g., Novartis and Bayer). The DTx market is estimated to increase to \$8.7 billion in 2025, with an average

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

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 improve-

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 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

IEEE/CAA Journal of Automatica Sinica (SCI IF 6.171, Top 11%) Peer-review 후 revision 완료

# 참여 논문 및 특허, 수상경력



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



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



https://github.com/Jinsan-Dev

