RADemics

IoT Enabled Mental Health Monitoring and AI Driven Cognitive Behavioral Therapy Systems for Personalized Treatment

Manasa H S, Yashaswini P R, Kavana K V
MALNAD COLLEGE OF ENGINEERING

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[1]Manasa H S, Assistant Professor, ECE, Malnad College of Engineering Hassan, Salagame Rd, Hassan. mah@mcehassan.ac.in

[2]Yashaswini P R, Assistant Professor, ECE, Malnad College of Engineering Hassan, Salagame Rd, Hassan. ypr@mcehassan.ac.in

[3]Kavana K V, Assistant Professor, ECE, Malnad College of Engineering Hassan, Salagame Rd, Hassan. kkv@mcehassan.ac.in

Abstract

The integration of Internet of Things (IoT) devices with artificial intelligence (AI) and advanced blockchain technologies was redefining the landscape of mental health care delivery. This book chapter explores the design and deployment of IoT-enabled mental health monitoring systems and AI-driven Cognitive Behavioral Therapy (CBT) interventions, emphasizing their potential to deliver personalized, scalable, and privacy-preserving treatment solutions. Continuous data streams from wearable sensors and mobile platforms provide real-time insights into behavioral patterns and emotional states, enabling adaptive therapeutic responses based on dynamic user conditions. The chapter investigates secure data transmission mechanisms, identity authentication protocols, privacy risk modeling strategies, and regulatory compliance measures essential for the ethical handling of psychological data. By introducing blockchain and federated learning frameworks, the text highlights a decentralized approach to AI-based therapy that ensures data sovereignty, transparency, and trustworthiness. Through a multidisciplinary lens, the chapter presents architectural models, trust frameworks, and interoperability solutions that form the backbone of secure and intelligent mental health ecosystems. The fusion of emerging technologies in this context promises not only enhanced treatment accessibility but also a paradigm shift in patient empowerment and care outcomes.

Keywords: IoT, mental health monitoring, artificial intelligence, cognitive behavioral therapy, blockchain, data privacy.

Introduction

The global landscape of mental health care was undergoing a transformation driven by rapid advancements in digital technologies [1]. Rising prevalence of psychological disorders, limited access to qualified therapists, and social stigma surrounding mental illness have created an urgent demand for scalable, real-time, and personalized therapeutic solutions [2]. Traditional clinical infrastructures struggle to meet this demand, especially in underserved or remote regions [3]. The introduction of Internet of Things (IoT)-enabled monitoring systems and artificial intelligence (AI)-driven cognitive behavioral therapy (CBT) frameworks presents an opportunity to bridge

these gaps [4]. By embedding intelligent sensing and automated intervention mechanisms into daily life, these systems offer continuous mental health support that adapts to the unique behavioral patterns of each user [5].

IoT devices such as smartwatches, wearables, smartphones, and ambient sensors enable seamless and non-intrusive tracking of physiological and behavioral signals [6]. These devices collect diverse data, including heart rate variability, sleep cycles, activity levels, and voice or typing patterns, which are analyzed to infer mental states such as anxiety, depression, or stress [7]. This real-time behavioral data forms the foundation for intelligent intervention engines that deliver tailored therapeutic content [8]. AI algorithms, particularly those based on natural language processing and machine learning, process these data streams to adapt CBT strategies in accordance with evolving user conditions [9]. Such personalized digital therapy can reinforce positive behaviors, detect early signs of mental distress, and recommend interventions before conditions escalate to clinical thresholds [10].