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Ph.D. DISSERTATION DEFENSE

Candidate:	Mohammad Rahul Islam
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School/Department:	School of Engineering and Science / Systems and Enterprises
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Title:	A Novel Scalable, Low-Burden, and Privacy-Preserving Affective Mobile Sensing System for Mental Health Monitoring in Real-World Settings
Chairperson:	Dr. Sang Won Bae, Department of Systems and Enterprises, School of Engineering & Sciences
Committee Members:	Dr. Onur Asan, Department of Systems and Enterprises, School of Engineering & Sciences Dr. Feng Liu, Department of Systems and Enterprises, School of Engineering & Sciences Dr. Ting Liao, Department of Systems and Enterprises, School of Engineering & Sciences

ABSTRACT

Access to mental health resources remains a significant challenge worldwide, with over 450 million people affected by mental illness. The gap between those needing support and available caregivers continues to widen. Technological advancements have introduced various solutions, including Smartphone-Based Active Self-Reporting, Lab-Based Physiological Monitoring, Wearable Physiological Sensors, and Passive Behavioral Sensing via Smartphones, to aid in the early diagnosis and continuous monitoring of mental illness. However, these approaches often face scalability challenges due to high costs and significant user burden. To this, the widespread accessibility and ubiquity of smartphones offer an unprecedented opportunity to monitor mental health unobtrusively and continuously. While smartphones provide low-burden solutions to real-time monitoring and intervention, their sensing capability has only been limited to behavioral and social signals. As we know, mental illness is multifaceted and affects the behavioral, physiological, and social aspects of people's lives. This missed opportunity creates a gap in the sensing capabilities of smartphones for a holistic understanding of a person's mental health.

In my thesis, I explore the potential of using smartphone front-facing cameras to capture physiological signals—such as pupillary responses and facial expressions—for objective mental state assessment. Modern smartphones often rely on camera-based biometrics and facial recognition for effortless unlocking, capturing spontaneous, unfiltered facial snapshots hundreds of times daily. Unlike posed selfies, these snapshots reflect genuine expressions, free from biases like social desirability. By leveraging advanced AI to process this data directly on the device in real-time, my work ensures privacy, as images are never transmitted off the smartphone. This seamless, low-burden, and continuous approach can enable early detection, timely intervention, and ongoing monitoring of individuals at risk. The research demonstrates the feasibility of smartphone-based physiological sensing in naturalistic settings, laying the groundwork for scalable, accessible mental health solutions and advancing passive sensing technology for global impact.