SMARTPHONE BASED WIRELESS ASSISTIVE AUDIO SYSTEM FOR A SOCIAL DISTANCED PHYSICAL CLASSROOM

Dulanjana Yasara Liyanagama

219356E

Dissertation submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer Science

Department of Computer Science & Engineering

Faculty of Engineering

University of Moratuwa

Sri Lanka

June 2024

DECLARATION

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

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The above candidate has carried out research for the Masters dissertation under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of the supervisor: Dr. Kutila Gunasekara

Signature of the supervisor: ***UOM Verified Signature*** Date: 21st June 2024

ACKNOWLEDGEMENT

I would like to express my appreciation to everyone who helped make this research possible. I am especially grateful to my supervisor, Dr. Kutila Gunasekara, for his invaluable advice and direction in completing the project properly. I am extremely grateful for his assistance and support in continuing my research.

I am especially grateful to my brother, R. V. Chamindu Udesh, for his tremendous assistance throughout the research. Although there were numerous reasons for giving up the research project, you were the one who encouraged, motivated, assisted, and provided me with mental support.

This would not have been possible without my parents' support and affection. I am indebted to them for being a constant source of strength and blessings throughout my life.

It is my pleasure to acknowledge my batchmates who provided guidance and support throughout the project. Sincere appreciation to the Department of Computer Science of the University of Moratuwa for its assistance and heading the path to this research project.

I would like to applaud my coworkers at Axiata Digital Labs (Pvt) Ltd. for their unwavering assistance in managing my work and MSc research.

ABSTRACT

The COVID-19 pandemic has accelerated the adoption of virtual learning, resulting in reduced student feedback, social isolation, and inadequate face-to-face communication. During the pandemic, physically and socially separated classrooms with adequate precautions are an acceptable solution for the learning environment. A low-cost local area network-based solution capable of transmitting and receiving audio signals in a noisy and socially distant physical learning environment has been implemented to address this issue. Here, data communication is achieved through socket programming and network protocols. This research problem utilized audio multicasting for one-to-many communication and a peer-to-peer architecture. Along with effective message multicasting between network peers, a simple yet optimized algorithm for peer discovery has been developed.

The design and implementation of this data communication system involves tradeoffs among communication factors, including requirements, resources, constraints, and the user experience. In order to evaluate the implemented system, an experimental user study was conducted, and subjective user feedback is considered. The results of the evaluation of the testing procedures indicate that the implemented system satisfies the system requirements when either one or two people address the meeting simultaneously in both the large classroom lecture scenario and the small group discussion scenario. Moreover, customized peer discovery algorithms have produced near-perfect outcomes.

Keywords: *Socially distanced physical classroom; Socket programming; Audio multicasting; User subjective testing*

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LIST OF ABBREVIATIONS

Abbreviation	Description
API	Application Programming Interface
ALDs	Assistive Listening Devices
ASR	Automated Speech Recognition
CI	Cochlear Implant
FM	Frequency Modulated
GMAPA	Generalized Maximum A Posteriori Spectral Amplitude
HA	Hearing Aid
HASPI	Hearing-Aid Speech Perception Index
HASQI	Hearing-Aid Speech Quality Index
IL	Induction Loop
IR	Infrared
IP	Internet Protocol
LLC	Logical Link Control
MAC	Media Access Control
MB	Megabytes
MoBALS	Mobile Based Assistive Listening System
mDNS	Multicast Domain Name Service
NFMI	Near-field Magnetic Induction
P2P	Peer-to-peer
PIN	Personal Identification Number
RF	Radio Frequency
RTP	Real-time Transport Protocol
SSDP	Simple Service Discovery Protocol
SNR	Speech to Noise Ratio
SIM	Subscriber Identity Module
TCP	Transmission Control Protocol
UPnP	Universal Plug and Play
UDP	User Datagram Protocol
UI	User Interface
WebRTC	Web Real-time Communication

LIST OF APPENDICES