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Text to Speech through Bluetooth for People with Special Needs Navigation

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Short resume of Professor Christos Bouras



Christos Bouras is Professor in the University of Patras, Department of Computer Engineering and Informatics. Also he is a scientific advisor of Research Unit 6 in Computer Technology Institute and Press - Diophantus, Patras, Greece. His research interests include 5G and Beyond Networks, Analysis of Performance of Networking and Computer Systems, Computer Networks and Protocols, Mobile and Wireless Communications, Telematics and New Services, QoS and Pricing for Networks and Services, e-learning, Networked Virtual Environments and WWW Issues. He has extended professional experience in Design and Analysis of Networks, Protocols, Telematics and New Services. He has published more than 450 papers in various well-known refereed books, conferences and journals. He is a co-author of 9 books in Greek and editor of 2 in English. He has been member of editorial board for international journals and PC member and referee in various international journals and conferences. He has participated in R&D projects.

Outline

- Introduction
- Motivation
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- Proposed System
- Conclusion and Future Work
- Acknowledgment

Introduction

- There is an increasing demand for efficient indoor navigation systems
- GPS technology is used for positioning, but there are two main problems for indoor positioning
 - *the fact that physical obstacles inside a building cannot be labeled as obstacles from the GPS*
 - *the fact that signals can be absorbed by walls inside buildings*
- One of the most promising technologies for indoor positioning are Bluetooth Low-Energy (BLE) beacons and Ultra-Wide Band (UWB) beacons, because :
 - *After installation of the such beacons, the only equipment needed is a smartphone that incorporates BLE support*
 - *The BLE approach supports a large variety of mobile devices*
 - *The installation cost of UWB and BLE beacons is relatively low*

Motivation

- Blindness is the condition of lacking visual perception due to physiological or neurological factors
- People with blindness encounter many problems in everyday life
- According to World Health Association
 - *at least 2.2 billion people have a vision impairment or blindness*
 - *1 billion people includes those with moderate or severe distance vision impairment or blindness due to unaddressed refractive error, as well as near vision impairment caused by unaddressed presbyopia*
 - *the leading causes of vision impairment are uncorrected refractive errors and cataracts*
- The motivation of the paper is to improve two areas of social life of the blind people and in general people with special needs: convenience and security

Related Work-TTS

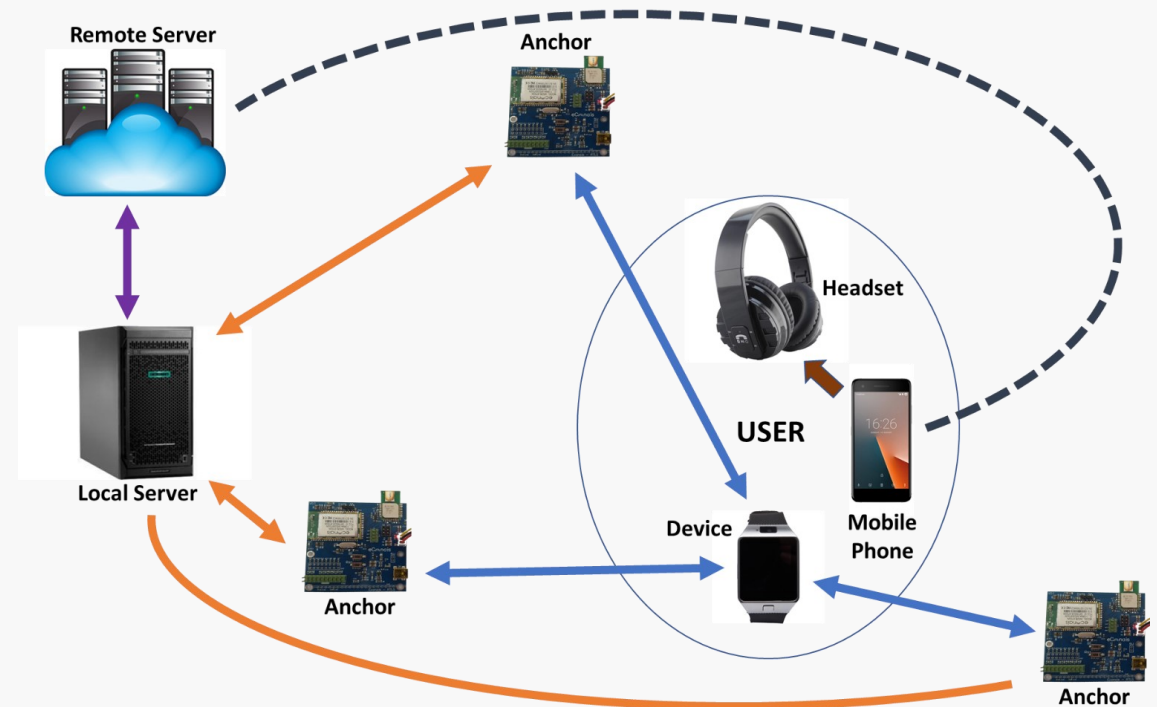
- Speech synthesis is the artificial production of human speech. Attempts to control the quality of voice of synthesized speech, several prototypes and fully operating systems have been built based on different synthesis technique
- the commands for the TTS conversion are provided through SSML language
- The GuideMe device will give commands through UWB beacons to the android application of GuideMe and the application – using the Google Cloud TTS shall provide the audio commands
- Watson is IBM's suite of enterprise-ready AI services, applications, and tooling. Watson TTS, converts written text into natural-sounding audio in a variety of languages and voices

Related Work-Bluetooth TTS

- PERCEPT indoor navigation system for the people who have visual issues and cannot see
- Using PERCEPT, blind users are supposed to access to public health facilities such as clinics, hospitals, and wellness centers, without the help of other people
- The creators of the PERCEPT system have also created the INSIGHT system, that is an indoor location tracking and navigation system for the blind people using RFID (Radio Frequency Identification) and Bluetooth connectivity technologies
- Also, a system of a portable TTS converter is designed in order to assist the blind listen to an audio of a text that has been scanned.
- Other systems, try to design and create a solution for visually impaired travelers, and specifically for the use case of train transportation using only smartphone and no other hardware

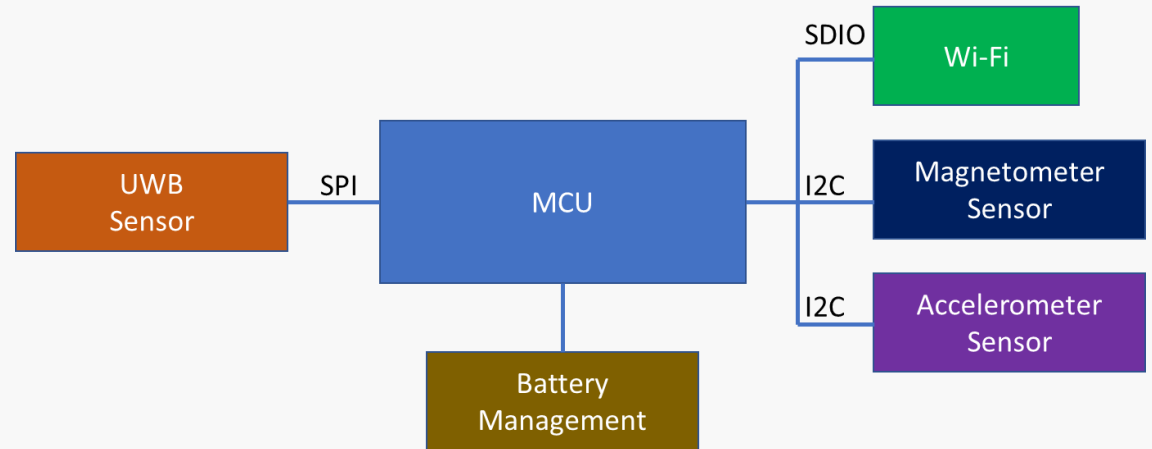
System Architecture [1/2]

- In our proposed system, the smart device can communicate to anchors via UWB technology, in order to locate the user
- The anchors are calculating and measuring the distance between the user and the anchor
- The distance data (between the user and the anchors), is transferred to a local server so as to measure the exact position, running positioning algorithms
- The local server, based on the positioning and navigation algorithms, will give commands (using Wi-Fi network) to the android application of GuideMe running at the user's android smart phone and the application – using the Google Cloud TTS - shall provide the audio commands.



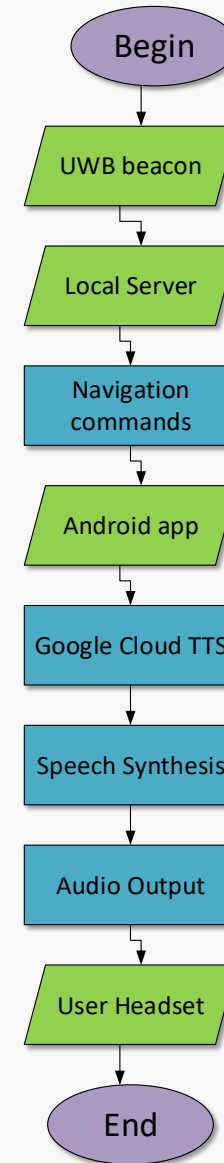
System Architecture [2/2]

- As far the wearable device is concerned, the processor that is chosen is the module made by Esspresif (Esspresif ESP32 0).
- In this module it is integrated a Wi Fi module, too. For the connectivity through UWB, we have chosen the module DWM1000 made by Decawave.
- The device consists of the magnetometer and accelerometer sensors, the UWB module, the Main Computing Unit and module for the battery management as well



Proposed System

- Device that will use UWB beacons to let the system identify its position and orientation precisely and provide this information to the android application of GuideMe and the application – using the Google Cloud TTS
- The commands for the TTS conversion are provided through SSML language
- A TTS system (a synthesis processor) that supports SSML will be responsible for providing a document as spoken output
- TTS is considered ideal for any application that plays audio of human speech to users



Conclusion and Future Work

- This work refers to the project of GuideMe using Bluetooth technology for text-to-speech directions given to people with difficulties
- Some previous research works on indoor navigation systems using text-to-speech technology were presented
- The text-to-speech technology through Bluetooth is used to guide the user through obstacles in indoor locations and for future work we may include an extension of this current research by also covering outdoor areas through the application

Acknowledgments

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Thank You!

Questions?

Remarks?

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