Smart-Cane Extended Bibliography (New ones start at 1.5)

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Contents

1   Summary of pages cited.

1.1   Smart cane that detects obstacles and water puddles in the way.

This project is very similar to what we are planning to do. It uses a whole system comprised of a walking stick, an Android mobile application, a Raspberry Pi, a GPS, and sensors. It also uses an app that can make the user communicate with their family or friends during an emergency by tapping the power button multiple times or by shaking their smartphone. We can use the idea similarly by having it call 911 or campus staff instead of their family members. This way they can get help during an emergency in a much faster way.[1]

1.2   Smart cane using Arduino.

This, again, is very similar to the ideas we have for our smart cane. This uses Ultrasonic sensors to detect obstacles and potholes, which correlates to our obstacle-detection idea. Instead of using an iOS mobile app, this uses an Android mobile app, but it is still the same logic: have the sensors send feedback to the phone and then the phone gives speech output to the user. This along with the use of GPS and an emergency alarm make it a good project to look into and try to improve it in our version.[2]

1.3   BlindSquare: an app for the blind

BlindSquare is a mobile app that determines your location and gives navigation feedback back to the user. It can tell the user if it is nearing a cafe, or some other place of interest. It also takes interactions, like shaking the device, to give information about the nearest intersections and streets. We can use this for our app and our cane to direct the users to the buildings and rooms that they want to get to. [3]

1.4   Using a cane with haptic and auditory feedback on Virtual Reality

Although this is all made in virtual reality simulations, it was made to test the effectiveness of audio/haptic feedback by a cane and how beneficial it could be for those who are visually impaired. The study showed that using said device did help the test subjects to navigate through the virtual world (they were blind). Since our

cane will also have the options of having audio and/or tactile feedback, then this study can help us see how these stimuli can affect the users. [4]

1.5   REXQualis: an Arduino builder kit

Since we only had 1 Raspberry Pi, we didn't want to leave all the testings to be done by just one person, as it would take a long time. I happen to own this Arduino kit and could test some of the components myself. So we decided that I would take some of the components that work on the Arduino and test them myself. On this kit, I found diagrams of the Ultrasonic Sensors that we have, which I used as guidance to wire the sensors to the UNO board and to code on the Arduino IDE. [5]

1.6   Adafruit's Arduino library for GPS module

I was going to do some tests on the GPS Module using my Arduino UNO. I used this website to look at the library so I could perform my tests. However, I learned that the UNO would not be sufficient for the GPS. The implementation in the website was using an additional Serial port for the communication between the GPS module and the Arduino. The problem is that the UNO has only 1 serial port, but the MEGA has 4. So I wasn't able to test it with my Arduino, but I still used this library to learn how to work with the GPS module. [6]

1.7   Adafruit's Arduino Library for the accelerometer and gyroscope

This website contains some example code for the accelerometer module. We're planning on using this module to track more accurately how much the user has walked along the track. The accelerometer is one of the components that I will test on my Arduino to speed up our testing process and will then be incorporated to the Raspberry Pi. [7]

1.8   Arduino reference on Serial Ports

After trying to use my Arduino UNO to test the GPS module, I saw that the code just could not compile because I needed to make another serial port. After hours trying to work my way around it, I got to this website and understood what the problem was. It explains how the Serial works with Arduino, and that the UNO only has 1 port used to communicate with the computer, whereas one like the

MEGA has SERIAL 1, 2, and 3 additionally. Aside from helping me understand the reason why I wouldn't be able to test the GPS with my UNO, it also gave a better understanding on how the Serial works for my future projects. [8]

References

[1] Nilima Sahoo, Hung-Wei Lin, and Yeong-Hwa Chang. "Design and Implementation of a Walking Stick Aid for Visually Challenged People." Sensors (Basel, Switzerland). MDPI, January 2, 2019.

[2] Hardik R. Shah, Dhiraj B. Uchil, Sanveg S. Rane, Prasanna Shete. "Smart Stick for Blind using Arduino, Ultrasonic Sensor and Android". *Department of Computer Engineering. K.J. Somaiya College of Engineering, Mumbai, India.* International Journal of Engineering Science and Computing, April 2017.

[3] "What Is BlindSquare?" BlindSquare. Accessed February 10, 2020. https://www.blindsquare.com/about/.

[4] Zhao, Yuhang & Bennett, Cynthia & Benko, Hrvoje & Cutrell, Edward & Holz, Christian & Morris, Meredith & Sinclair, Michael. (2018). Enabling People with Visual Impairments to Navigate Virtual Reality with a Haptic and Auditory Cane Simulation. 1-14. 10.1145/3173574.3173690.

[5] "REXQualis - North America." Rexqualis Industries,Ingenious & fun DIY electronics and kits. Accessed March 27, 2020. http://www.rexqualis.com/download/.

[6] Ada, Lady. "Adafruit Ultimate GPS Featherwing." Adafruit Learning System. Accessed March 27, 2020. https://learn.adafruit.com/adafruit-ultimate-gps-featherwing/arduino-library.

[7] Siepert, Bryan. "LSM6DSOX And ISM330DHC 6 DoF IMU." Adafruit Learning System. Accessed March 27, 2020. https://learn.adafruit.com/lsm6dsox-and-ism330dhc-6-dof-imu/arduino.

[8] "Serial." Arduino Reference. Accessed March 27, 2020. https://www.arduino.cc/reference/en/language/functions/communication/serial/.