Submitted to: Dr. Own

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Assignment#2

If you are a blind person, you want to design a RFID crutch for the further usage. Please tell me the system design, flowchart, cost, what kind of frequency will you adopt in your system?

Introduction:

The visually impaired person may use a cane, guide dog or ask for assistance from a person for guidance. However, the mobility and autonomy of the visually impaired person may be limited especially when he/she navigates an unfamiliar environment. The visually impaired person is usually challenged when moving from one place to another. Sounds or echoes are the guide of the visually impaired person to determine obstacles and pathways to analyze an environment. We need to design a crutch that aims to solve the important ergonomic and usage problems of the conventional crutches with its simple and aesthetic form instead of the using mechanism. Another concern is to provide holding alternatives by the continuous form in order to divide the pressure in the hand while holding the handle, which is the biggest problem of conventional crutches. Radio frequency identification (RFID) has been an emerging technology. RFID technology can be implemented for navigation, especially for the blind.

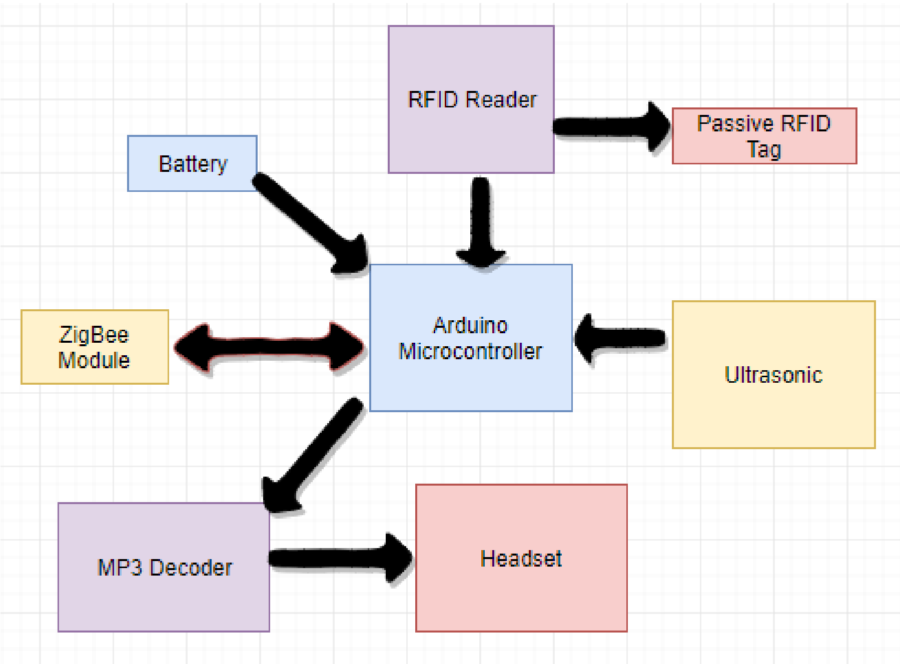
System design:

Detecting distance sensors, such as RFIDs, ultrasonic sensors and infrared sensors, are usually used to modify guide canes. Regarding the RFID sensing method, a RFID reader module is installed on a guide cane, and a large quantity of RFID tags are positioned underground for positioning and navigation. Such assistive devices are not widely used and are difficult to apply in real-life situations; in addition, without large quantities of RFID chips being positioned underground in advance, the system cannot work. Regarding ultrasonic and infrared sensors, they are cheap and easily implemented into a guide cane. These kinds of sensors can precisely determine the distance and notify the visually impaired people there are obstacles front, but they cannot recognize the obstacle categories. In more advanced design, multiple infrared sensors can detect special cases such as stairs, but still cannot detect the more complex shape of the obstacle. This study implemented the RFID technology which consists of a low-cost RFID reader and passive RFID tag cards. The passive RFID tag cards served as checkpoints for the visually impaired. The visually impaired was guided through audio output from the system while traversing the path. The study implemented an ultrasonic sensor in detecting static obstacles.

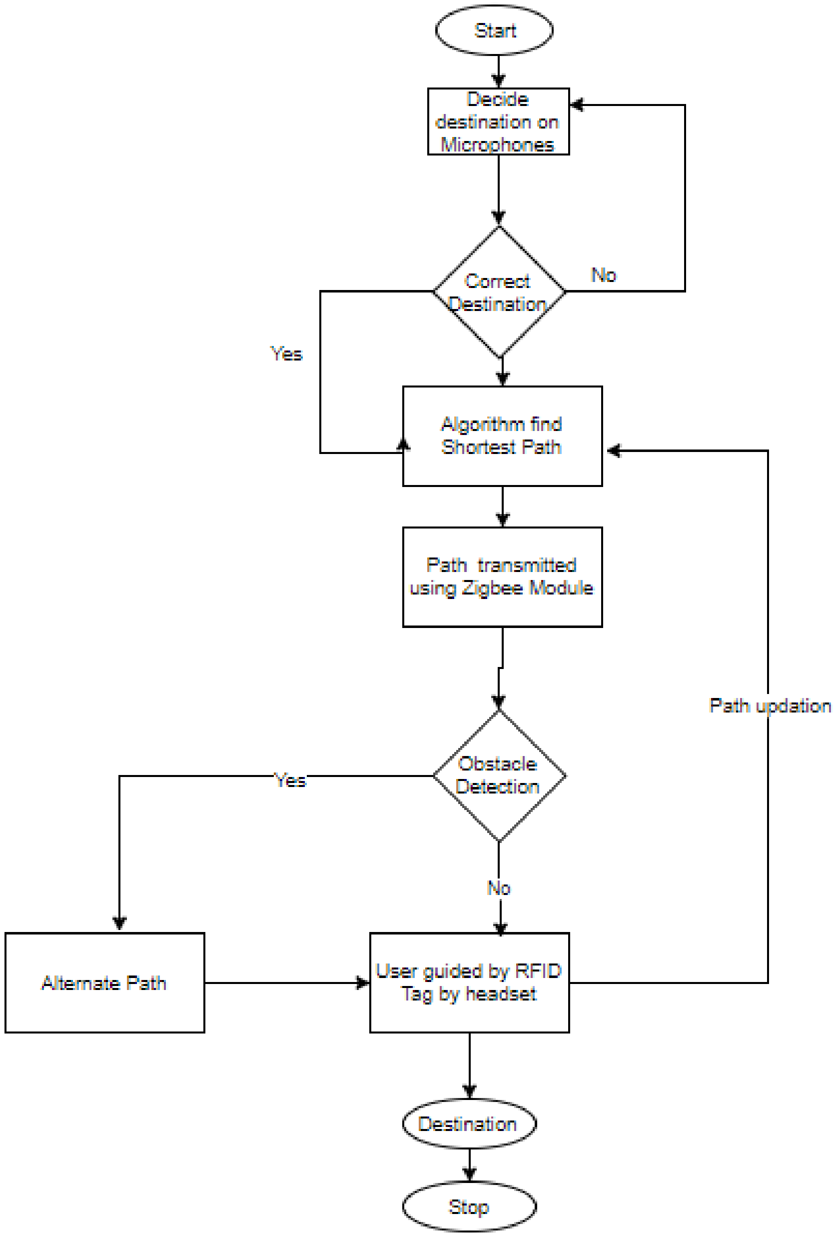
Methodology:

The conceptual idea of crutch for the visually impaired is divided into different components. The first component of the system is the cane. The cane consists of the following: microcontroller, RFID reader, obstacle detection sensor, ZigBee module and the mp3 decoder for the headset. The appropriate location and installation of RFID tags in the intended environment is specified first by the author. Each RFID tag has a unique ID. There are two types of RFID tags: active and passive. The type of RFID tags that is implemented in the study are passive tags. Passive tags don't require power source and it cost less compared to active tags. The RFID tags are mounted on the ground in such a manner that the tags are equidistant from each other, with a distance of less than 1 m (more precision) from each other, to avoid collision from the reader. Previous studies implemented RFID tags as checkpoints. The destination is selected first by the person using the laptop or mobile. After selecting the destination, the user is guided to the next RFID tag by the system via headset. The user will receive instructions by hearing the basic commands for direction (forward, turn left, and turn right.) from the headset. The algorithm is implemented in the program installed in the laptop. The algorithm is applied to determine the shortest path to the selected destination. The shortest path generated by the algorithm is transmitted to the microcontroller unit using ZigBee module. ZigBee modules can communicate within 150 meters indoor range. Each time the RFID reader detects a RFID tag, the microcontroller will verify the unique ID. The ID will be checked by the microcontroller if the user is still along the path. If not, the software will generate an alternative path, using the same algorithm, for the user to traverse. In case the sensor detected an obstacle before the tag, the microcontroller will send a signal to the laptop that will request an alternative path generated by the algorithm. The new path for the user is transmitted to the microcontroller via ZigBee. The system will notify the user via headset when he/she reached the destination. The system learns and maps the obstacles detected.

Conceptual Diagram:



Flowchart:


Start
Decide destination on Microphones
Correct Destination
No
Yes
Algorithm find Shortest Path
Path transmitted using Zigbee Module
Path updation
Obstacle Detection
Yes
No
Alternate Path
User guided by RFID Tag by headset
Destination
Stop