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Department of Computer Engineering

Semester: 1

IOT Mini Project

Smart stick for blind people

Internet of Things Laboratory - CE4103

Class: Final Year

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1. Introduction to the Concept

In this project a smart stick has been designed. It can be used by blind people or old people with poor vision. It employs an ultrasonic sensor to detect the distance between the person and the obstacles and thus helps blind people to walk without worrying.

The smart blind stick proposes a simple, efficient, and configurable electronic guidance system for visually impaired people and aids in their mobility regardless of whether they are outdoors or indoors.

The proposed system is unique as it uses an ultrasonic sensor to collect all reflective signals in order to detect an obstacle using a microcontroller (Arduino Uno R3).The stick notifies the user via buzzer and audio that an obstacle was detected.

2. Need of Concept

Independent mobility is a precondition for people with visual conditions to live a quality life .However, due to vision loss, mobility can be very challenging for blind people. As a result, the life quality of blind and visually impaired people is affected negatively and accidents happen especially in mobility-related tasks. Our project aims to solve this problem for the visually impaired people. This smart stick will warn blind people about obstacles and help them avoid obstacles in front of them.

In this smart stick an ultrasonic sensor has been used along with buzzers and a mini speaker. When the object is within 10 to 20 cm of the ultrasonic sensor, the buzzers beep alerting the blind person of the nearby object. And when the obstacle is within 10 cm of the sensor, an audio clip saying “Alert the object is near” is played. Hence whenever an object is within 20 cms of the stick the blind person is alerted.

In a technology-controlled world where people strive to live independently, this smart stick for blind people aids them in achieving personal independence. It is simple to use due to its low cost and non bulky structure.

3. Systems Requirement for Project Implementation

Hardware Requirements

- Arduino Uno
- Ultrasonic sensor HCSR04 (measures the distance between the sensor and the target object)
- 2 Buzzers
- Jumper wires(male to male and male to female)
- Breadboard
- 9V DC Battery
- Mini Metal Speaker with wires (8 ohms 0.5W)
- Arduino Uno cable to connect arduino to laptop for uploading code

Software Requirements

- Arduino IDE (Text editor for writing code. It connects to the Arduino hardware to upload programs and communicate with them.)
- PCM library to play audio using Arduino
- Audacity software - Audacity is a free and open-source digital audio editor. It is used to change the audio file format to 16 bit PCM and project rate to 8000Hz.
- Encode Audio-It is software used to convert the audio to base64 and use the result string in the code for playing audio using Arduino.

4. Design methodology:

Step 1. Purpose and Requirements Specification

Purpose-To develop smart stick for blind people that will help them in obstacle detection and save them from colliding into objects while walking.

Behavior- Our system has the functions for sensing obstacles within different ranges with the help of ultrasonic sensor and indicates these ranges via buzzers and speaker. The buzzers beep when the obstacle is detected in the range of 10 to 20 cm. And the speaker plays an audio message "Alert! the object is near" when the obstacle is detected within 10 cm of the sensor.

System Management Requirement- The system should provide accurate obstacle detection within 20cms in the path of the user and alerts the user via beeping buzzers or playing an audio clip.

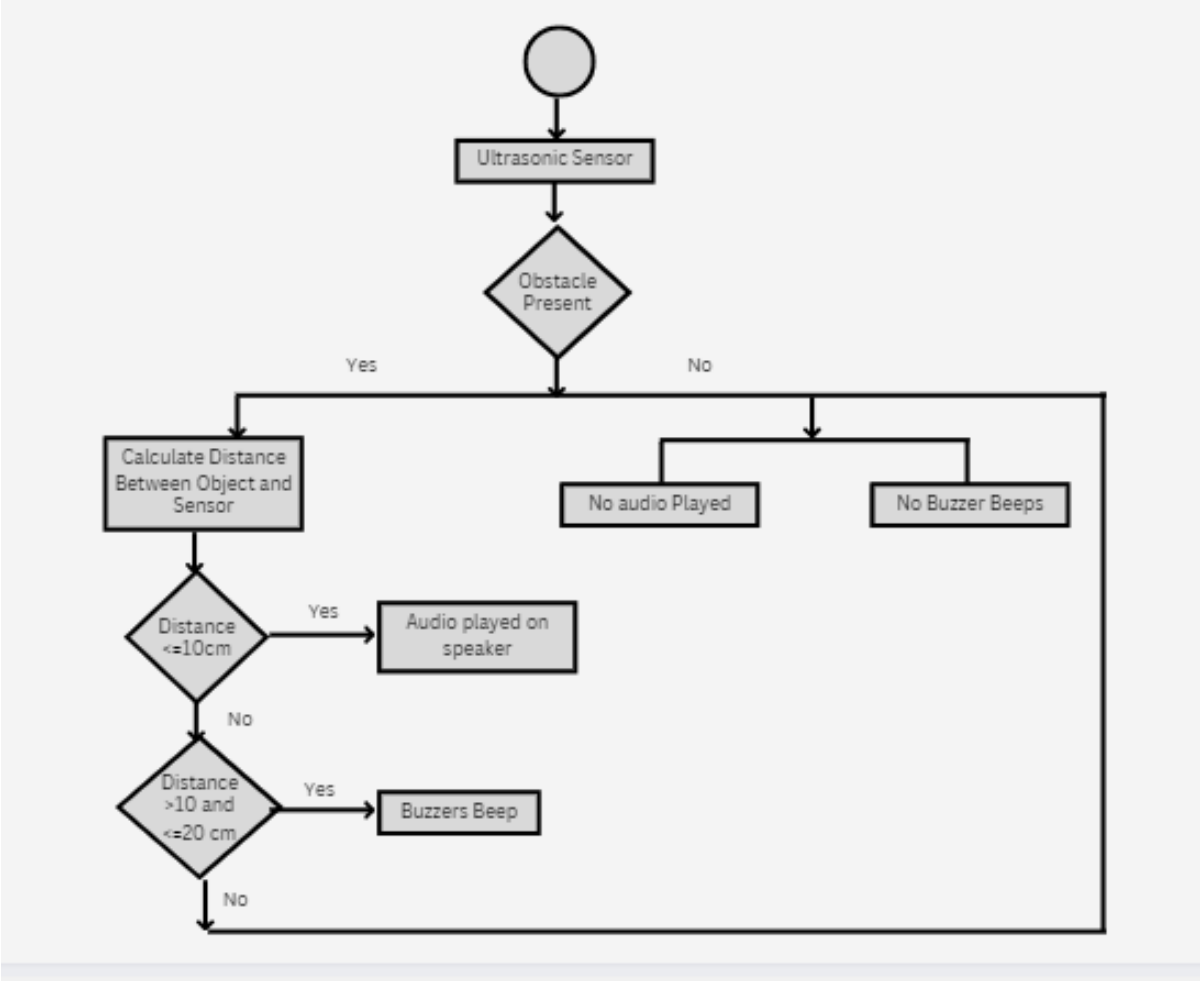
Data Analysis Requirements- The system will classify the data(obstacle presence) into two categories -obstacle detected and obstacle not detected.

Application Deployment Requirement-Application should be deployed locally by the user.

Security Requirement-System should be reliable and detect the obstacles accurately. The system does not have any user security capabilities.

Step 2 . Process Model Specification

The second step in the IOT design methodology is to define the process specification. In this step, the use cases of the IOT system are formally described based on and derived from the purpose and requirement specifications. The figure given below shows the process diagram for smart sticks for blind people.



Step 3. Domain Model Specification

The third step in the IOT design methodology is to define the Domain Model. The domain model describes the main concepts, entities, and objects in the domain of the IOT system to be designed. The domain model defines the attributes of the objects and the relationships between objects. Domain model provides an abstract representation of the concepts, objects, and entities in the IOT domain, independent of any specific technology or platform. With the domain model, the IOT system designers can get an understanding of the IOT domain for which the system is to be designed.

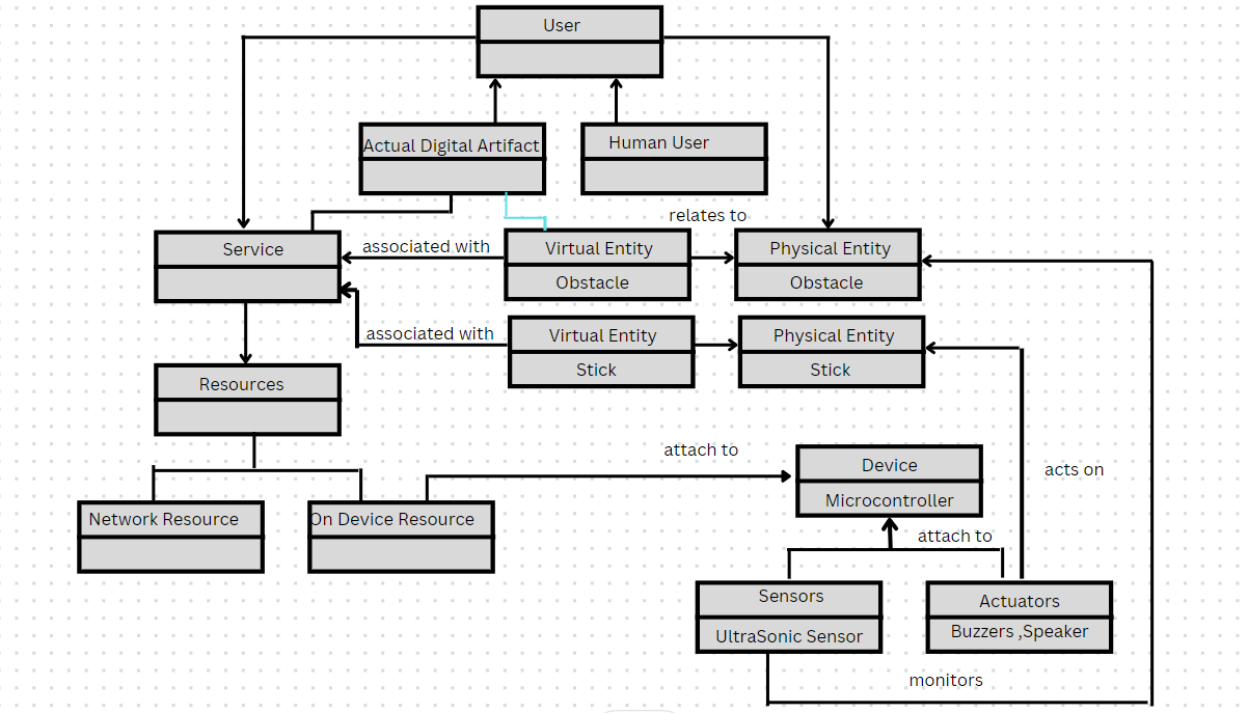
Physical Entity: Stick, Obstacle

Virtual Entity: Stick, Obstacle

Device: The device is the stick that has the sensor and the arduino circuit attached to it.

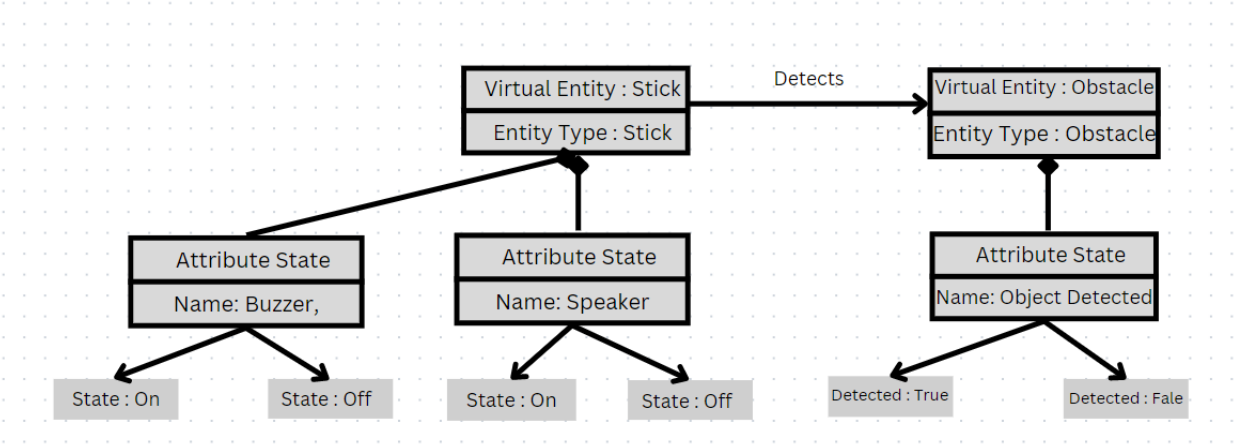
Resource: On device resource- microcontroller (Arduino UNO)

Service: A service to sense the obstacle



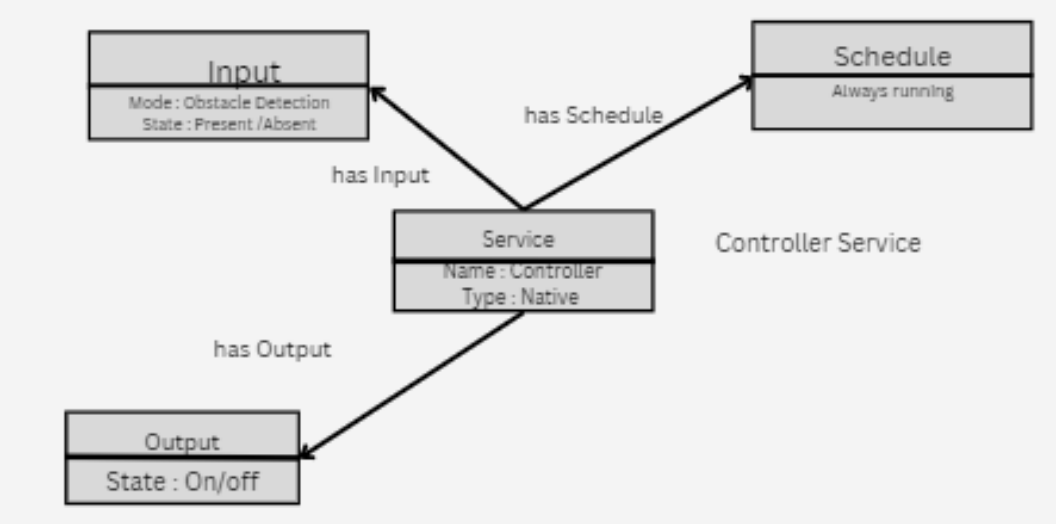
Step 4. Information Model Specification

The definition of the Information Model is the fourth phase in the IoT design methodology. The structure of all the information in the IoT system is defined by the information model, which includes relations, properties of virtual entities, etc. The specifics of how the information is represented or stored are not covered by the information model.



Step 5. Service specification

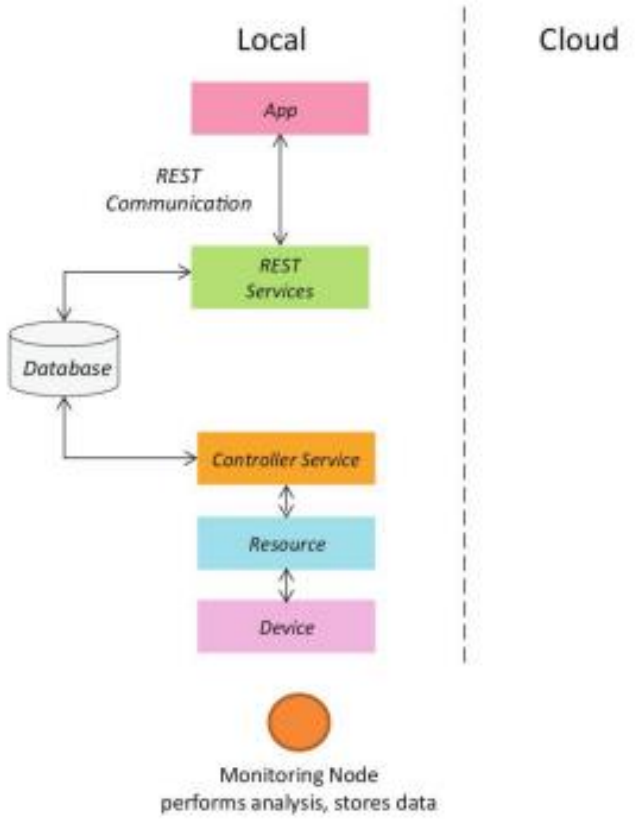
The service specifications are defined in the IoT design methodology's fifth phase. Service specifications define the services in the IOT system, service types, service inputs/outputs, service endpoints, service schedules, service preconditions and service effects. From the process specification and information model, we identify the states and attributes. For each state and attribute, we define a service. This service changes the state values and retrieves the current values.



Step 6. IOT Level Specification

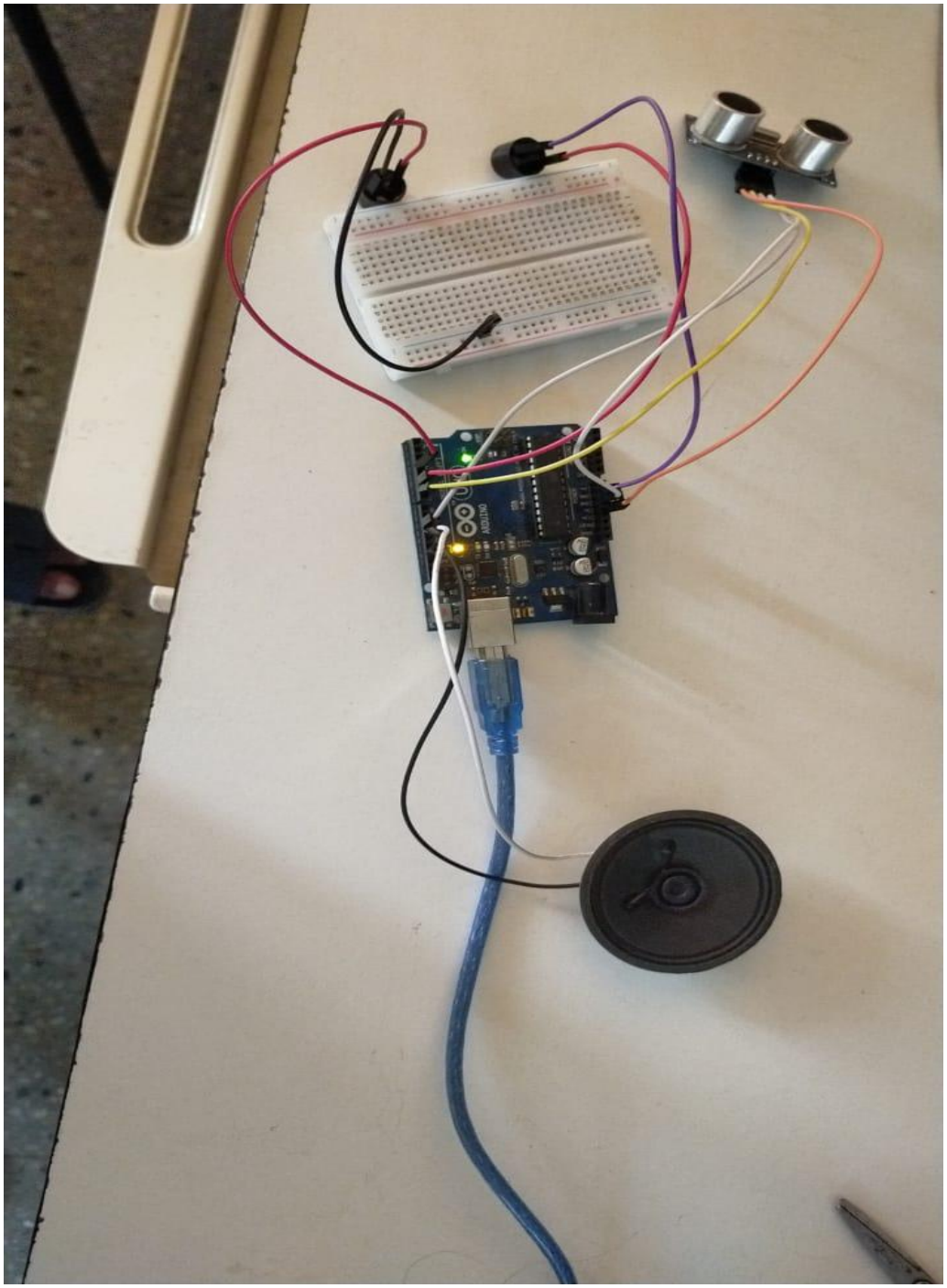
This System is based on IoT Level-1.

Since we are using only one IoT device and also not using a data storage system that's why the system is of IoT level 1.



Step 9. Device and Component Integration-

The ninth step in the IoT design methodology is the integration of the devices and components.



Output Serial Monitor ×

Not connected. Select a board and a port to connect automatically.

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Distance: 207
Distance: 207
Distance: 206
Distance: 206
Distance: 206
Distance: 206
Distance: 207
Distance: 7
Object Alert
Object Within 10cm
Distance: 20
Object Alert
Object between 10cm to 20cm
Distance: 20
Object Alert
Object between 10cm to 20cm
Distance: 21
Distance: 21
Distance: 22
Distance: 21
Distance: 21
Distance: 22
Distance: 21
Distance: 22
Distance: 21
Distance: 21
Distance: 22
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Future Scope

- Add GSM module to the smart stick to support messaging
- Add GPS module to the smart stick for tracking the blind person