Intelligent Stick
(Vision for Visually Impaired)

Capstone Project Report

End-Semester Evaluation

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NOVEMBER 2018

ABSTRACT

Vision is the most critical piece of human life as 83% of the data about condition is being gone through the visual perception. In this world there are around 36 million individuals who are visually impaired and around 246 with low vision. Matured People and Visually hindered individuals discover trouble in distinguishing the moment subtle elements of deterrents lying on their way. They are completely ignorant of the environment, which can once for a while cause dangers to their life. To make economic advancement of society and additionally to encourage the matured individuals and the outwardly hindered feel more engaged and don't depend on other individuals the new-innovation is clarified through this paper. This paper plans to build up a stick that will help the outwardly disabled and additionally matured individuals to move starting with one place then onto the next with the possess without taking assistance from any person. In the time of coming new advancements, the framework proposed in this paper utilizes the most recent innovation like Natural Language Processing (NLP) for discourse acknowledgment process as the individual gave contribution to any dialect one is agreeable in and dialects basically utilized are English and Hindi utilizing mic which is associated with stick by means of Bluetooth and changing over into content and by separating catchphrases from the information given by the client will be coordinated with GPS. GPS will store the last area with the assistance of MAP store in the memory of Raspberry Pie which goes about as a CPU for the stick. The stick additionally incorporates sensors like ultrasonic which serves to identifies the obstruction along the way also, cautions the client utilizing discourse module of NLP. The stick will progressively refresh the current area in the frame scope and longitude and guide the client as needs be in the dialect chosen by the client from those dialect proposed by the framework in which the client will be agreeable in with the assistance of discourse acknowledgment which is the module of NLP. Watchwords Natural Language Processing (NLP), Speech acknowledgment, Obstacle location, GPS, MAP, Raspberry pie.

DECLARATION

We hereby declare that the design principles and working prototype model of the project entitled Intelligent Stick (Vision for Visually Impaired) is an authentic record of our own work carried out in the Computer Science and Engineering Department, TIET, Patiala, under the guidance of Dr. Parteek Bhatia during 6th and 7th semester (2018).

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ACKNOWLEDGEMENT

We would like to express our thanks to our mentor Dr. Parteek Bhatia. He has been of great help in our venture, and an indispensable resource of technical knowledge. He is truly an amazing mentor to have.

We are also thankful to Dr. Maninder Singh, Head, Computer Science and Engineering Department, entire faculty and staff of Computer Science and Engineering Department, also our friends who devoted their valuable time and helped us in all possible ways towards successful completion of this project. We thank all those who have contributed either directly or indirectly towards this project.

Lastly, we would also like to thank our families for their unyielding love and encouragement. They always wanted the best for us and we admire their determination and sacrifice.

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LIST OF ABBREVIATIONS

STT	Speech to Text
ML	Machine Learning
TTS	Text to Speech
NLP	Natural Language Processing
AI	Artificial Intelligence
IOT	Internet of Things
API	Application Programming Interface

INTRODUCTION

This segment portrays the prologue to the proposed framework. Here, the light is tossed upon the issue articulation because of which the fundamental thought of the undertaking was considered.

1.1 PROJECT OVERVIEW

Vision is the most basic piece of human life as 83% of the data about the earth is being gone through the visual perception. In this world there are around 36 million individuals who are visually impaired and around 246 with low vision. Outwardly debilitated individuals discover trouble in recognizing the moment points of interest of impediments lying on their way. They are completely ignorant of the surroundings which can in some cases cause dangers.

1.1.1 PROBLEM STATEMENT

According to the survey, it is known that the visually impaired youth faces a lot of challenges and fear a lot of things. Visually-impaired youths evinced quantitative and qualitative differences in their self-reported fears. It stops them from facing the day to day challenges of the life like a normal being. It is also recorded that they have low self-confidence and are mostly dependent on someone for their daily needs, due to which they are mostly considered as the liability of the society. These people are highly talented and have all the abilities to do something and earn a good name and earning but due to their fear and dependency on others, they are considered as a liability.

To make the visually impaired feel more empowered, safe and increase their mobility on road/streets, we plan to develop a smart stick which will ensure their self-dependency so that they don’t have to rely on other human beings.

1.1.2 GOALS

The aim is to give them more freedom to walk down the roads safely with the help of their new companion, namely, the smart walking stick. The domain of our project is to make a stick that will assist visually impaired using earpiece and a mike to provide the measures such as obstacle detection (fast moving vehicles, pits/sink-holes, puddles etc.),

and also help them navigate using global positioning system (GPS), also we will use multiple language corpora so that visually impaired gets an ease in handling the stick using one of the languages the person is comfortable in.

1.1.3 SOLUTIONS

To extend the use of multi-language corpus to ease the availability of the languages. This will help the user to select the language of his choice, which will help the user to use cane easily. The text to speech conversion and speech to text conversions makes it easier for the user to handle the cane as a user can have a direct conversation with it and can set the language and the navigation path by telling the source and destination locations.

The obstacle detection is of the utmost priority as if they are not detected the safety of the person will be at stake. The obstacle detection is the perception of potentially hazardous objects in the environment ahead of time, while the latter one concerns the manner to convey obstacle information to the visually impaired people. The obstacle detection in this project is focused with ultrasonic sensors, water sensors (to make them safe from water spills muddy areas etc.) to provide them safety so that the mobility is increased and extra help is decreased.

Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. If they strike an object, then they are reflected as echo signals. Whenever an obstacle is detected the commands are issued to “be safe” or “move left/right”, which will help the user to be safe and increase the confidence in them. This work will be done on python using the raspberry pi and NLP modules, GPS module and MAP API interfacing module.

The basic functionalities that are stated above are the main concern of the project with this, the visually impaired will get a lot of help and will be able to compete in the world and earn well in life.

1.2 NEED ANALYSIS

Till date many technical enhanced have been done in respect to stick by providing the comfortable environment to the visual impaired.

The first innovative stick was the one, where if any obstacle would come in his way then the stick tends to vibrate (the obstacles where sensed with the help of ultrasonic sensors) and warn the person.

The second smart stick experiment was somewhat different from the above this time the IOT based environment was used to detect the obstacle and the warning message was given(using siren and also by using Speech Recognition)[1].

The third IOT based stick was made which sent location to the relatives using GPS Tracker and many improvements were done as some stick inculcate the feature of sensing the water on the ground or fire etc. Some smart stick also help the blind in the stair case using infra-red sensor [2].

The fourth type of stick was made which use of camera and with the help of image processing the stick would able to recognize what is in-front of the person and tell him about the view with the help of speech recognition.

Our project is unique because we are providing all the basic features that are sensing of any obstacle, water, fire in one stick which will tell person through speech recognition using multiple languages corpus and also we are giving one more feature that is we would place GPS Tracker which will help person to reach their desired location by their own rather to take help from others with the path tell by the stick as well as the obstacle come in the way. The person will be provided with a stick and a ear piece. Ear Piece include speaker and mike for the double-sided communication means destination is set by the person and directions as well as instructions if any obstacle came in path of the person would be given by the stick. Also, our stick will communicate with person in 2 different languages 1) English 2) Hindi so that person is able to use any of the language in which the one is fell comfortable.

1.3 PROBLEM DEFINITION AND SCOPE OF PROJECT

Vision is the most important part of human life as 83% of the information about environment is being passed through the eye sight. In this world there are about 36 million people who are blind and about 246 with low vision. Visually impaired people find difficulty in identifying the minute details of obstacles lying on their way. They are fully unaware of the surroundings, which can sometimes cause threats.

The scope of the project is to provide more freedom to Visual Impaired so that they can walk down the roads safely with the help of their new companion, namely, the smart walking stick. The domain of our project is to make a stick that will assist visually

impaired using earpiece and a mic to provide the measures such as obstacle detection (fast moving vehicles) and also help them navigate using global positioning system (GPS), also we will use multiple language corpus so that visually impaired gets an ease in handling the stick.

1.4 ASSUMPTIONS AND CONSTRAINTS

This section explains the assumptions and constraints about the project. They are mentioned in the Table1 below.

Table 1: Assumptions and Constraint of the proposed system.

S. No.	Assumptions/constraints
1	Assume that this is a smart stick for visually impaired and it is used under the following conditions: If the language is not defined the default will be considered as English.
2	The stick will function only if the battery/ power source is fully charged.
3	Let us assume that the stick is not meant to use in the area with high traffic.
4	The internet connection is must for the functioning of the navigation in the smart stick.

1.5 OBJECTIVES

The primary objectives of this project are as follows:

i. To extend the use of English corpus as an application of Natural Language Processing.
ii. To convert text to speech and vice-versa with the help Speech Recognition and Natural Language Processing.
iii. To detect the obstacle using ultrasonic sensors.
iv. To interface different sensors with each other and build communication between stick and earpiece.
v. To Navigate using map API interface.

1.6 METHODOLOGY USED

To complete our objective, we started with literature review to know the hardware and software requirements of our project also analyze the feasibility of our project in every

manner. Prototypes will be discussed along with different modules and their respective coding. Afterwards we will move forward on the practical implementation.

Methodology to achieve our objectives as follows:

i. NLP and Speech Recognition:
   - To use built in corpuses or develop one using NLP for two languages.
   - To move forward with the effort to convert speech to text and text to speech conversion and match it with the corpus and then execute the statements.
   - To use machine learning models to increase the accuracy of our results.

ii. Obstacle detection using Sensor unit:
   - To study the sensors under different conditions like fast moving vehicles, at different angles etc.
   - To pool the output of different sensors to the speech using python.

iii. Navigation using GPS Interface:
   - To get the current location and destination location with the help of GPS tracker and the path between them with the help of a map which will be saved in memory, then we will move ahead with an objective of helping the person to get his path again using the concept of NLP and Speech Recognition.
   - If any sensor will get active during this navigation frame, it will get more priority. Till all the sensors are not giving clear signals for that time the navigation system will be on hold.

iv. The stick will get recharge using a battery of 2200mAh.

After building all the modules we will integrate them. Testing will be our next phase to make it more feasible, reliable and compatible in every aspect. Also, we will try to do further improvements to make stick more useful for the visually impaired.

1.7 PROJECT OUTCOMES AND DELIVERABLES

The blind people are considered as the liability of society, now by providing the smart stick, dependency on others are reduced. The conversion of speech to text and text to speech will simplify the task for visually impaired. English corpus used in the smart stick, a user can choose one and can operate the stick. The obstacle detection is of utmost

priority which will be handled with the ultrasonic sensors, water sensors. In case of an obstacle detection alert, messages using AI voice commands will be issued to the user. The navigation will take place with the help of MAP API and GPS module, the user will give the source and destination locations, later the navigation path will be given to the user again using the AI commands (move left/right/straight), if an obstacle comes, the navigation will be at halt for a while, then again the process of navigation will start. The change of discourse to content and content to discourse will rearrange the errand for outwardly disabled. It utilized in the savvy stick, a client can pick one and can work the stick. The obstruction identification is of most extreme need which will be dealt with the ultrasonic sensors.

REQUIREMENT ANALYSIS

This section explains about the requirement which helped to make the project more accurate and reliable. This section includes Software Requirements, Cost Analysis, Work Breakdown Structure of the project.

2.1 LITERATURE SURVEY

The literature survey includes the current knowledge including substantive findings, as well as theoretical and methodological contributions to the topic.

2.1.1 THEORY ASSOCIATED WITH PROBLEM AREA

The aim is to build the intelligent stick for visually impaired. The ideas hit to the mind to solve the social problems with the knowledge. The area of research is Artificial Intelligence, thus trying to embed the Artificial intelligence as Internet of thing (IOT). Till date, many developments have been made like when the obstacle comes, the stick vibrates, stair case detection and telling the description of the obstacle. But, our project designs to provide navigation to the person using GPS and try to embed it with obstacle detection phase using speech recognition. Thus, the project started with the research on GPS, obstacle detection, text to speech and speech to text, artificial intelligence etc.

2.1.2 EXISTING SYSTEM(S) AND SOLUTIONS

The section explains the already working system that are already exists. Here, the Table 2 below describes about the already existing system till date.

Table 2: Characteristics of sticks made for visually impaired.

S No.	Name of the author and year	Name of The Product	Features	Technology Used
1	Tamboli et al.[2017]	IOT based smart stick [3]	The stick helps in: Detect obstacle and alert the blind people through speech input/output. Provide help for using stair case.	Raspberry pi, vibration motor, GPRS shield, IR proximity sensors, Ultrasonic sensors, NLP
2	Sukhija et al.[2014]	Smart stick for blind man [4]	The stick provides a smart way for blind people: It follows the black line and Magnetic	Microcontroller ATmega8, L293D IC for motor driver, IR sensor

			field using it the person using would reach the destination.	
3	Wahab et al.[2011]	Smart Cane: Assistive Cane for visually impaired person [1]	Sense the obstacle in a range. Senses water on the ground. Generate a voice warning message on sensing the obstacle.	MPLAB, Ultra-sonic sensor, Microcontroller (work as a CPU), Water sensor
4	Nada et al.[2015]	Effective Fast Response Smart Stick for Blind People [5]	Detects water on the ground. Stick vibrates on sensing the obstacle. Message is passed using earphone.	Ultrasonic sensors, Infrared sensor, Water sensor, Microcontroller, Dc motor, GPS receiver
5	M. P. Khil ari V. P. Bhope [2015]	Review on speech to text conversion methods [6]	The stages of speech recognition: Analysis, Feature extraction, Modelling, Testing.	NLP
6	R.Sandanala kshmi [2015]	Speaker Independent Continuous Speech to Text Converter for Mobile Application [7]	Pre-processing, Framing, Windowing, Feature Extraction, Speech Recognizer using Neural Network.	Speech recognition, NLP
7	M.P. Khilari V.P.Bhope [2017]	Implementati on of Speech to Text Conversion [8]	Speech Recognition Techniques: Speech analysis, Feature Extraction, Modelling, Testing	NLP, Raspberry pi Speech recognition
8	N. Damdhare [2011]	Smart stick for blind [2]	Sends location to the relatives/family using GPS tracker and sense obstacle.	Ultrasonic sensor, GPS module, Proximity sensor, Stereo camera, Vibratory circuit

2.1.3 RESEARCH FINDINGS FOR EXISTING LITERATURE

The table below specifies all findings of the literature survey in Table 3.

Table 3: Research Findings for Existing Literature

S. No.	Roll No. and Name	Paper Title	Findings	Citation
1	101510055	Blind: Obstacle Smart stick for Blind	Obstacle detection for blinds.	N.Damdhare [2]
2		A review on speech to text conversion methods	Use of NLP for noun extraction.	M.P. Khilari V.P. Bhoge [6]

3	Parika Gupta	Speaker Independent Continuous Speech to Text Converter for Mobile Application.	Use of Speech processing and NLP.	R.Sandanalakshmi [7]
4		Implementation of Speech to Text Conversion	Speech Processing using NLP	P. Khilari V.P. Bhoge [8]
5		Speech to Text Conversion in Real-time	NLP for text conversion.	N.A. Nafis S.Hossain [9]
6		Speech Recognition System: A Review	Speech Processing using NLP	N.Wahani S. Sharma [11]
7	101510067 Riwik Agrawal	Smart Stick for Blind Man	Use of raspberry pi and sensors for obstacle detection.	N.Sukhija et al.[4]
8		A Practical Obstacle Detection and Avoidance System	proximity sensors and obstacle detection	S.Badal et al.[15]
9		Real-Time Obstacle Detection System in Indoor	Obstacle indoor are detected using sensors.	H.Pham et al.[16]
10		Ultrasonic Obstacle Sensor for Aiding Visually Impaired	Sensors for helping obstacle detection.	V.D.Earisha [18]
11		Review Article A Review Paper on Raspberry Pi	Functionality and uses of the pi.	[20]
12		Raspberry Pi as Internet of Things hardware	Using Pi with IOT.	M.Maksimovic et al. [21]
13	101510095 Mili Supreet	Smart Cane: Assistive Cane for Visually-impaired People	Stick helps blind for navigation.	M.H.A. Wahab et al. [1]
14		Speech-To-Text Conversion Using HMM	Use of HMM for speech to text.	S.M.Mon H.M. Tun [10]
15		A Review on Speech Recognition Technique	Conversion from text to speech.	B.W Gawali [12]
16		A Review on Automatic Speech Recognition Architecture	Working of speech processing model.	S.Karpagavlli E.Chandra[13]
17		Voice Recognition System: speech-to-text	Conversion from speech to text.	P.Das et al.[14]
18		Obstacle by Ultrasound Sensors	Obstacle detection using ultrasound sensor.	A.K. Shrivastava et al. [24]
19	101690005 Ishita Parmar	IOT Based Smart Stick for Blind	Obstacle detection and Navigation	A.R.Tamboli [3]
20		Effective Fast Response Smart Stick for Blind People	Obstacle detection And Navigation	A. Nada et al. [5]
21		Obstacle Detection Techniques for Navigational Assistance	Obstacle detection And Navigation	N. Amin M. Borschbach[17]
22		An Ultrasonic Navigation System for Blind People	Ultrasonic sensors, Obstacle detection and Navigation	M.B. Salah et al. [19]
23		Raspberry Pi Technology: A Review	Raspberry Pi as Technology	H. Chaudhri [22]
24		Obstacle Detection using Ultrasonic Sensors	Obstacle Detection using Ultrasonic Sensors	P.D.S Vidhya et al.[23]

2.1.4 PROBLEM IDENTIFIED

The problem identified through the literature survey is that the work on the stick is going on but every stick has its own advantage as shown above some providing obstacle detection or some providing stair detection to the person, but till now no stick provide both navigation as well obstacle detection simultaneously with the advance environment given is that there is no bound of language means that the person is free to communicate with stick in any language the one to do.

2.1.5 SURVEY OF TOOLS AND TECHNOLOGIES USED

To carry out with the literature survey the methodology used by the members is to read all the research paper to get the wide idea about what all the research is done till now and how the specified project is innovated by the members.

Our research is more focused on idea rather than research paper. We used various tools for making literature survey:

i. Web Browser to look for research papers.

ii. Mendeley for references and to manage literature.

iii. Adobe Crater for making PDF.

iv. Microsoft word to format and write the literature survey.

2.2 STANDARDS

A standard is an authoritative principle or rule that usually implies a model or pattern for guidance, by comparison with which the quantity, excellence, correctness, etc., of other things may be determined.

i. IEEE 802.11STANDARDS

It is an arrangement of media get to control (MAC) and physical layer (PHY) determinations for executing remote neighborhood (WLAN) PC correspondence. They are the world and most broadly utilized remote PC organizing norms, utilized in most home and office systems to permit workstations, printers, and cell phones to converse with one another and get to the Internet without associating wires.

ii. AES (ADVANCED ENCRYPTION STANDARD)

The Advanced Encryption Standard (AES) is a determination for the encryption of electronic information set up by the U.S. National Institute of Standards and Technology (NIST).

2.3 SOFTWARE REQUIREMENT SPECIFICATIONS

The goal of this requirement specification document is to provide a unified view, common understanding of the functions of the prototype version for the Comment Sentiment Analysis Tool for English Language CSATEL and guidance to the development of the software system taking into consideration the project overall business plan, and user requirements**.**

2.3.1 INTRODUCTION

This section introduces about the project. It describes about specification of project. It also states about requirements of the project.

2.3.1.1 PURPOSE

This Software Requirements Specification (SRS) documents key specifications, describes a prototype in terms of functional and non-functional requirements for Intelligent Stick (Vision for Visually Impaired). The information documented, helps the intended audience to design and develop the product. We are launching an official prototype version and make amendments in it according to user needs.

2.3.1.2. INTENDED AUDIENCE

Primary readers of this document are the IOT researchers, Software and Hardware developers and Intended Audience. This document is intended for the following:

- **Developers:** In order to be assured they are developing the right project that full fills requirements provided in this document.
- **Testers:** In order to have an exact list of the features and functions that will respond according to requirements and provided diagrams.
- **Documentation writers:** To know what features and in what way they will explain. What technologies are required, how the system will response in each user's action etc.

- **System administrators:** In order to know exactly what they will expect from the system, right inputs and outputs and response in error situations.

2.3.1.3. PROJECT SCOPE

The scope of the project is to provide more freedom to Visually Impaired so they are able to walk down the roads safely with the help of their new companion, namely, the smart walking stick. The domain of our project is to make a stick that will assist visually impaired using earpiece and a mike to provide the measures such as obstacle detection (fast moving vehicles, pits/sink-holes, puddles etc.), and also help them navigate using global positioning system (GPS), also we will use multiple language corpus so that visually impaired gets an ease in handling the stick using one of the language the person is comfortable in.

2.3.2 OVERALL DESCRIPTION

The description about the project is mentioned below under different sections. The section mainly explains the product perspective and Product features.

2.3.2.1 PRODUCT PERSPECTIVE

Vision is the most important part of human life as 83% of the information about environment is being passed through the eye sight. In this world there are about 36 million people who are blind and about 246 with low vision. Visually impaired people find difficulty in identifying the minute details of obstacles lying on their way. They are fully unaware of the surroundings, which can sometimes cause threats.

To make the visually impaired feel more empowered, safe and increase their mobility on road/streets, we plan to develop a smart stick which will ensure their self-dependency so that they don't have to rely on other human beings.

The purpose of the prototype is to provide a little help to visual impaired so that they feel more empowered, safe and increase their mobility on road/streets, with the help of the smart stick which will ensure their self-dependency so that they don't have to rely on other human beings.

2.3.2.2 PRODUCT FEATURES

The architecture diagram of the tool is shown in Figure 1. This tool will provide the following functions:

- The stick will activate with the help of a button and it will provide the choice to the person to select the language for communication through another button, if not selected, then the stick will communicate with the default language.
- As the stick will activate corresponding to it all the sensors will get active as well.
- If the person wants to navigate to the desired location they will speak through voice recognition the location converted into the text and the corresponding path to reach the final destination is saved using map (already saved in memory) and the GPS Tracker provide the change in longitude/latitude which helps the person to navigate and the person will direct by the stick through artificial human voice.
- If any of the sensor will get activate during the navigation time, it will get priority and warning will be given to the person with the help of artificial human voice.
- The stick will work with the help of the battery to provide energy to sensor and raspberry pi microcontroller.

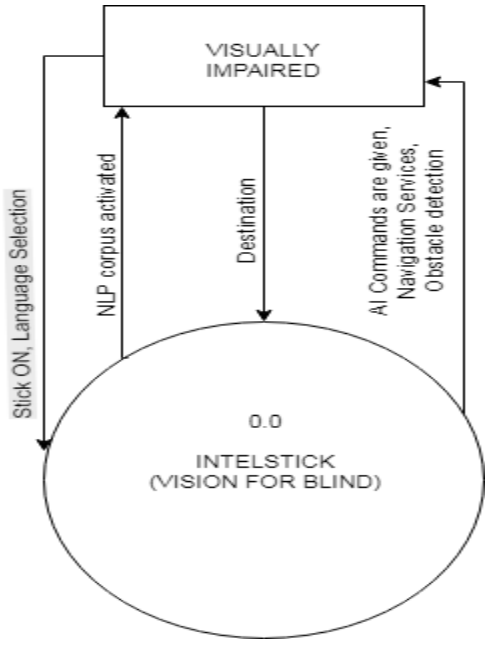

Figure 1: Context Diagram

2.3.3 EXTERNAL INTERFACE REQUIREMENTS

The section explains about the interface requirements under this section. Some light is thrown on the user, hardware and software interfaces.

2.3.3.1. USER INTERFACES

User interface includes a stick with an earpiece. The person should press the button to power on the stick and second button to choose the language in which one wants to communicate with.

2.3.3.2. HARDWARE INTERFACES

The solution makes extensive use of several hardware devices. These devices include Ultrasonic Sensor for Obstacle detection and water sensor to sense the muddy area or water comes in the path of the person. Raspberry Pi used to process and build communication between all the parts of the system. Bluetooth and Earpiece to provide the communication between the stick and the person.

2.3.3.3. SOFTWARE INTERFACES

In Raspberry pi the Text to Speech and vice-versa convertor is present provide the communication between the stick and the person. All the codes are in Python because the working of raspberry pi is supported in python.

2.3.4. FUNCTIONAL REQUIREMENTS

This section illustrates the functional features using the following template in tables below in Table 4, Table5 and Table 6.

Table 4: Functions Performed by Obstacle Detection Module.

System Feature	Obstacle Detection and Water Detection
Priority	High
Description	Identifying if any obstacle or muddy or water comes in the path of the person.
Action	This module is activated if any one of the ultrasonic or water sensor will activate. Then the signal is sent to raspberry pi and text will convert into speech.
Result	Then corresponds to that sensor coding the stick will direct the person in which direction one to move with the help of artificial human voice.
Functional requirements	There is a function in Python code for ultrasonic and water sensor.

Table 5: Functions Performed by MAP API.

System Feature	GPS Module and MAP API
Priority	Medium
Description	The user can give the desired location where one wants to reach through AI commands.
Action	When person gives destination point the GPS tracker saves longitude and latitude of

	current location in temporary variable and fetch the longitude and latitude of destination through MAP API and find the optimal path to reach to the desired location as MAP API gives the array of longitude and latitude to GPS Tracker.
Result	The GPS Tracker take the location specified by the map and helps in navigation. The Map API will return an array includes longitude and latitude values through which the GPS tracker able to navigate.
Functional requirements	A Navigation and MAP API module.

Table 6: Functions Performed by NLP Module.

System Feature	Speech to Text and Vice-versa
Priority	Medium
Description	The command given by person is converted to text and on detecting the obstacle or navigation the text is converted to speech.
Action	The command given by person is converted to text for selecting the desired location and on detecting the obstacle or navigation the text is converted to speech for providing communication.
Result	The stick will be able to communicate with the user.
Functional requirements	Speech Module

2.3.5 OTHER NON-FUNCTIONAL REQUIREMENTS

Non-functional requirements are important as all the requirements are considered below in this section.

2.3.5.1 PERFORMANCE REQUIREMENTS

As for this prototype version during the testing the performance of the system in terms of the efficiency and throughput given by the system after the integration of different components.

2.3.5.2 SAFETY REQUIREMENTS

Raspberry pie is highly efficient to perform tasks so make our system efficient. High quality sensors are used with good coding to make system effective. New features will be added in future of needed. If any of the sensor are not working than the warning message is given to person.

2.3.5.3 SECURITY AND PRIVACY REQUIREMENTS

There are specific security requirements, only the command which is given in the mic should be taken as order and all the noise must be neglected while taking the decision by the stick.

2.4 COST ANALYSIS

The Table 7 given below describes the cost analysis for the proposed system.

Table 7: Cost Analysis of the system.

DEVICE	FUNCTION	COST (Rs)
Ultrasonic sensor	It will detect the distance in range 2cm to 450cm and will give signal if there is any fast-moving obstacle in that range.	109*3= 327
Mic	It will take the user command in the form of voice and helps in further processing it is attached to the pi.	580
Raspberry pi	It is a micro controller that is compatible with python and we are using python because of availability of libraries related to natural language processing and it is indeed needed in our project for speech to text and text to speech transformation.	2710
EAR PIECE	It is used to listen the commands and alert message given by the stick.	300
GPS MODULE	GPS module can be used for developing an advanced real-time navigation system which is helpful for getting longitude and latitude for map API interfacing in our project.	1100
POWER BANK	We use power bank as battery backup for our project.	2000
	TOTAL	7,017

REQUIREMENT ANALYSIS

This section explains about the requirement which will help to make the project more accurate and reliable also includes Investigative techniques, Proposed Solution, also Work Breakdown Structure for the proposed system.

3.1 INVESTIGATIVE TECHNIQUES

According to the mentioned above techniques this project uses the descriptive technique of the investigative techniques this is because as mentioned in the descriptive technique the new models, concepts and systems are designed. The stick is designed keeping in mind all the aspects, to assist the visually impaired. The stick starts with the power button. Second step is to set the language which is preferred by the user. After language setup, the next step is to set the current location and the destination of the user. Now the navigation module shall be activated. The artificial voice will help him by issuing the commands. Simultaneously, the obstacle detection module will start to keep the user safe from the obstacles. The obstacle detection module is given the utmost priority as the safety of the users is must.

3.2 PROPOSED SOLUTION

To extend the use of multi-language corpus to ease the availability of the languages. The text to speech conversion and speech to text conversions makes it easier for the user to handle the cane as a user can have a direct conversation with it and can set the language and the navigation path by telling the source and destination locations.

The obstacle detection is of the utmost priority as if they are not detected the safety of the person will be at stake. The obstacle detection is the perception of potentially hazardous objects in the environment ahead of time, while the latter one concerns the manner to convey obstacle information to the visually impaired people.

Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. If they strike an object, then they are reflected as echo signals. Whenever an obstacle is detected the commands are issued to “be safe” or “move left/right”, which will help the user to be safe and increase the confidence in them.

3.3 TOOLS AND TECHNOLOGIES USED

i. Putty: PuTTY is an exceptionally flexible device for remote access to another PC. It's most likely utilized all the more regularly by individuals who need secure remote shell access to a UNIX or Linux framework than for some other reason, however that is just a single of its numerous employments.

ii. GTTS: GTTS a Python library and CLI apparatus to interface with Google Translate content to-discourse API. Composes talked mp3 information to a document, a record like question for further sound control.

iii. Google Trans: Google trans is a free and boundless python library that executed Google Translate API. This uses the Google Translate API to make calls to such techniques as recognize and interpret.

iv. Py Audio: Py Audio gives Python ties to Port Audio, the cross-stage sound I/O library. With Py Audio, you can without much of a stretch utilize Python to play and record sound on an assortment of stages.

v. Python: Python is a deciphered abnormal state programming dialect for broadly useful programming. Made by Guido van Rossum and first discharged in 1991, Python has a plan rationality that accentuates code lucidness, outstandingly utilizing critical whitespace.

vi. Raspbian OS: Raspbian is a free working framework dependent on Debian streamlined for the Raspberry Pi equipment. A working framework is the arrangement of essential projects and utilities that make Raspberry Pi run.

3.4 WORK BREAKDOWN STRUCTURE

A work breakdown structure in undertaking administration and frameworks designing is a deliverable-situated breakdown of a venture into little parts. A work breakdown structure is a key venture deliverable that arranges the collaboration into sensible areas.

The Project Management Body of Knowledge (PMBOK) characterizes the work breakdown structure as a "deliverable arranged progressive disintegration of the work to be executed by the undertaking group." Breaking the complex structure into simpler items are shown below in Figure 2.

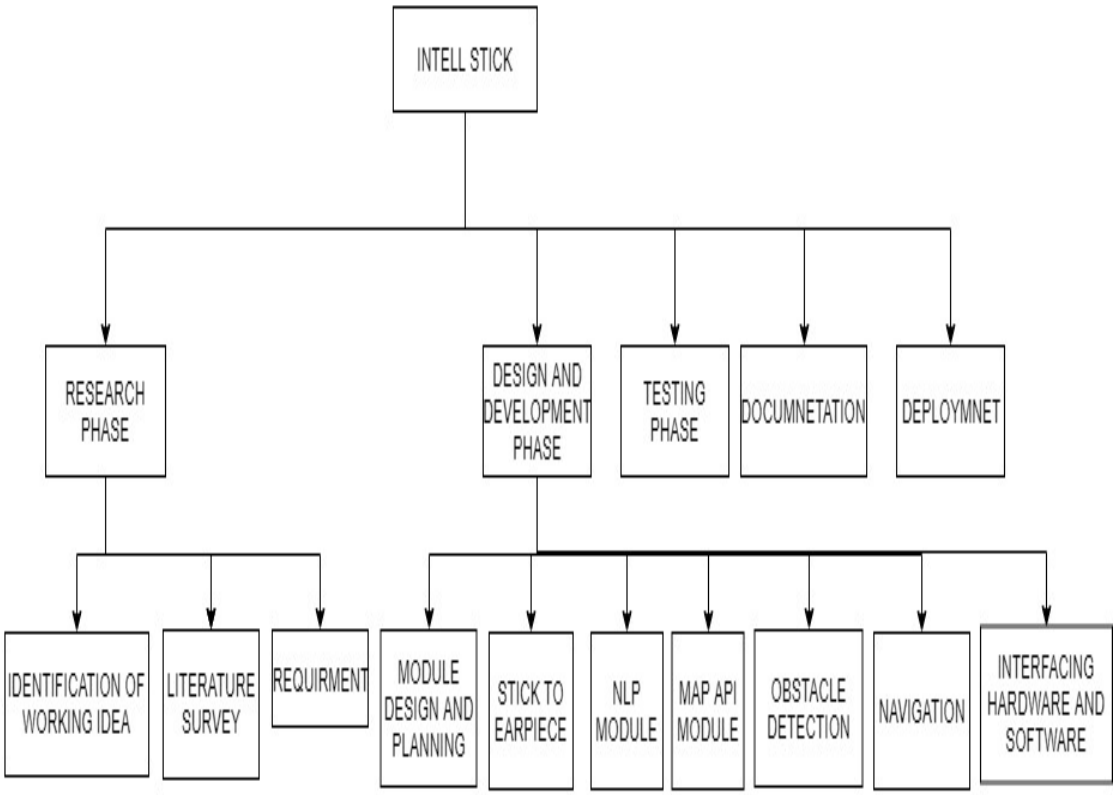

Figure 2: Work Breakdown Structure

DESIGN SPECIFICATIONS

The design specifications are considered in this section. All the phases such as the system phase and the user-interface are described below under the various section. It helps understand the project more conveniently.

4.1 SYSTEM ARCHITECTURE

The venture is a customer server application, two-level. The customer handles both Presentation and application layer and the server layer handles the database layer. Customer framework sends the demand to the server framework and the Server framework forms the demand and sends back the information to the customer framework. It is two-level due to the database being the diverse layer as the other two layers are the piece of the equipment, not a fundamental piece of the product application. Figure 3 alludes to the two-level which depicts the equivalent.

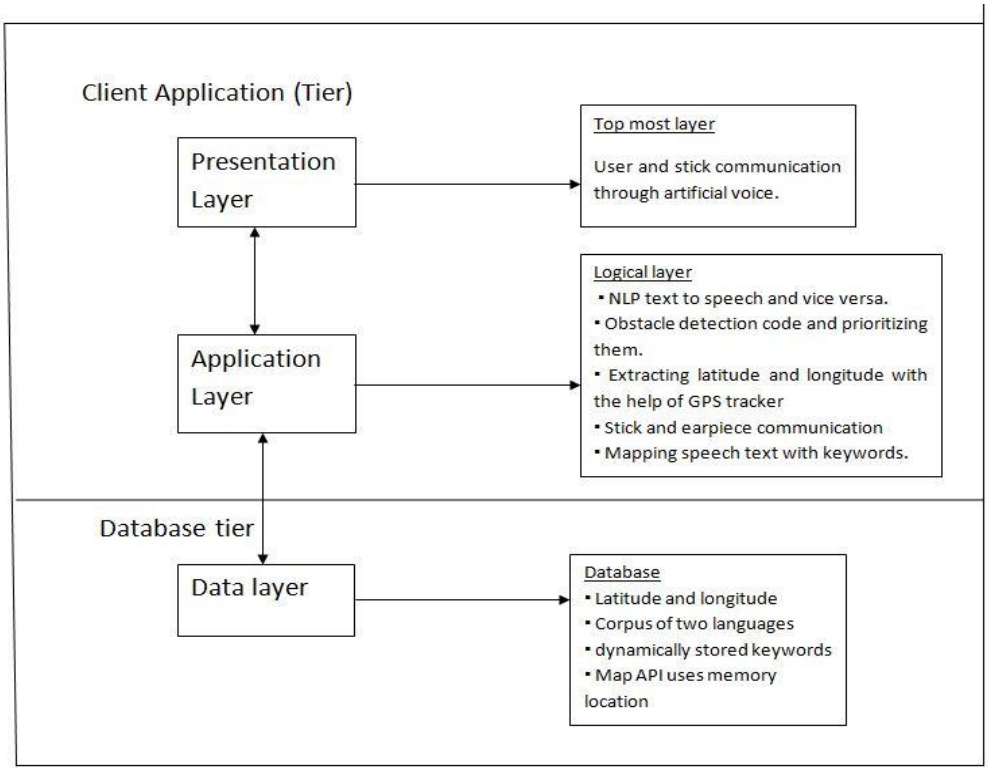

Figure 3: System Architecture of the project.

System Components: This area incorporates about the correspondence held between various sort of equipment to complete every one of the exercises in the synchronized way. Segments utilized are Sensors (Ultrasonic and Water), GPS Tracker Module, Navigation Module, Raspberry Pie Interfacing, MAP API Module, Speaker and Mic. Figure 4 depicts every one of the segments of the venture underneath.

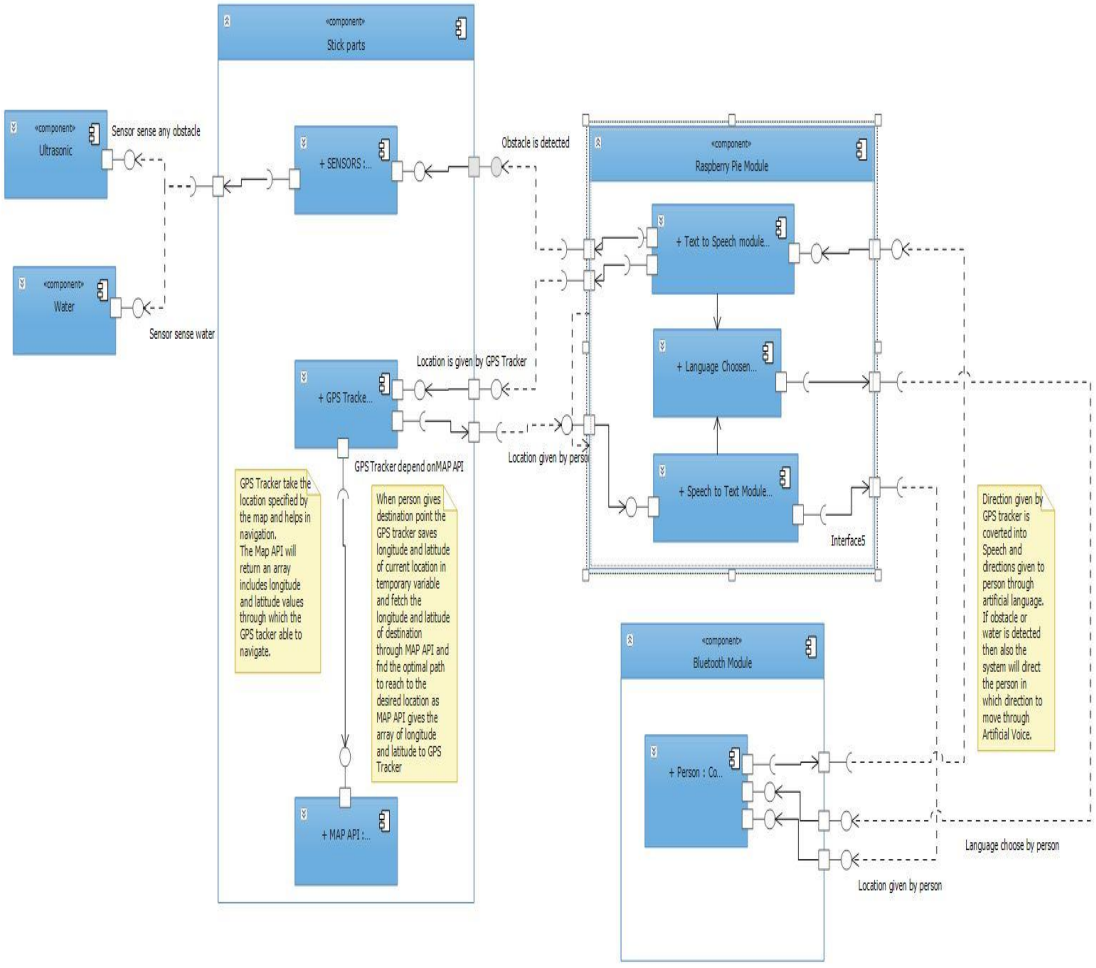

Figure 4: System Component Diagram of the project

4.2 DESIGN PHASE

This area finishes up about the essential movement performed by every module and encourages the client to reach to the goal. Figure 5 beneath portrays the grouping of the task.

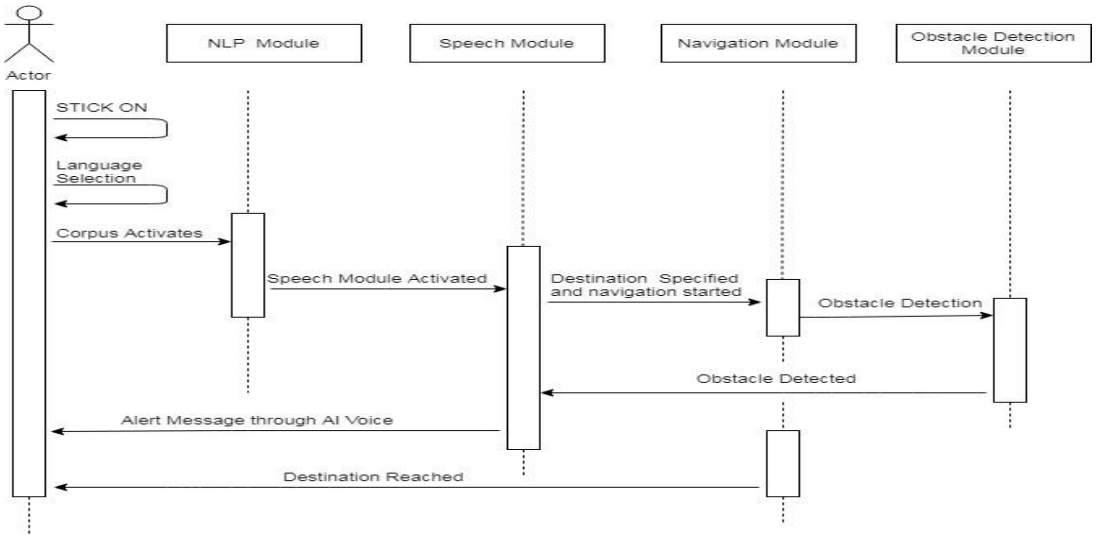

Figure 5: Sequence Diagram of the project.

Data Model: This Section closes about how the information will spill out of one segment to another and which action is to be performed by utilizing that information in Figure 6 given underneath.

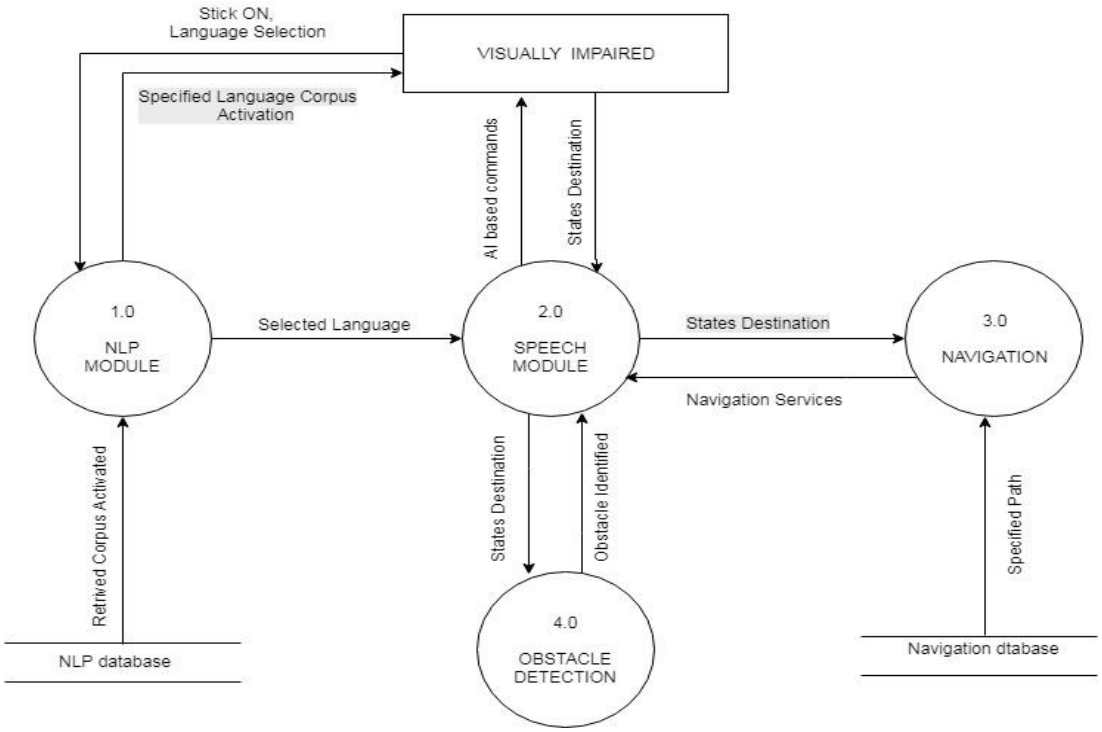

Figure 6: Data Model of the project

4.3 USER INTERFACE DIAGRAMS

This area finishes up about the fundamental correspondences held among every one of the parts likewise how the client will cooperate with the stick and the other way around and the Figure 7 will be given underneath.

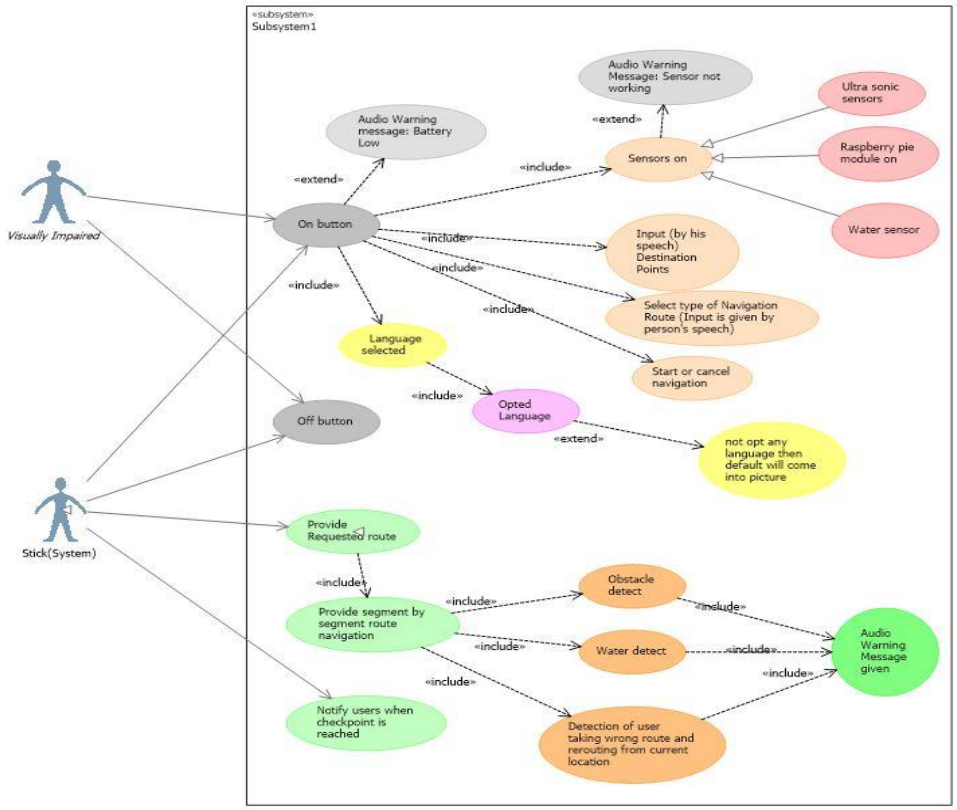

Figure 7: Use Case/Design Phase of the project.

The Table 8 below describes the above diagram in detail for easy understanding.

Table 8: Use Case Template

Use Case	Elaborate the functional flow of our system
Actors	Visually Impaired, Stick (System)
Description	The visually impaired will interact with the smart stick which will help the person to detect if any obstacle is present in the way or muddy area comes into the path, the stick will give warning to person through artificial human voice and also help the person to reach to the destination point given by the person through voice recognition with the help of GPS tracker and guide the person with artificial human voice. The language is selected by the person in which one is comfortable also the person will be able to find his stick if his stick has been misplaced by him.
Pre-conditions	The stick must be fully charged before the start of the navigation. All sensors

	in the stick should work properly. While different modules were communicating among each other no interference would be generated.
Flow of Events (include conditional flows here as they occur)	The stick is on using a push button. As the stick gets on by the person, then all the sensors will get automatically on. The person will choose the language using the other push button, if the language is not chosen then the default language will come into the memory of the stick and starts communication with the person. The destination and the type of travelling mode is selected by the person. As the person reach his destination, the stick will inform the person regarding the same through audio message. When the stick will switch off by the person all the work will stop which was performing by the stick. When the battery is charged, then audio message given by the stick.
Post-conditions	The person will able to reach exactly to his desired location. Obstacles, muddy area and water would be detected correctly and would save person from the unwanted accidents.
Alternative Flows	If battery is low, then an audio warning message will be given to the person. If the destination is not given by the user than all the sensor will work according to the work assigned to them. If obstacle is detected or muddy area is detected than the audio warning message will be given to the person. Else the given destination is track by the GPS tracker with the help of the map and then segment by segment navigation will start by the stick and helps the person to reach to his desired destination. If some obstacle is detected or some water or muddy area is detected on the way of the user than at that point of time till all the sensors will get clear the navigation will stop and the warning message will be given to the person with the help of the human artificial voice. If in the middle of the process, the battery of the stick is drained out then the audio warning message will be given to the person.
Priority	Obstacle Detection: HIGH Water Detection: HIGH Navigation: MEDIUM
Non-Functional Requirements	Sensors are highly reliable. Security is maintained in all respect (communication among all the sensors and modules is held smoothly without any interference).
Assumptions	All sensors should work proper and GPS tracker tracks the exact location pointed by the person.
Outstanding Issues	GPS tracker not able to track the exact location referred by the person. Also, the sensors are not able to sense any obstacle that comes in the path of the person while walking.

All the details about the use case are described in the use case template. It becomes easier to understand about the functionality of the use case diagram through this template. The end user with its help finds it easier for the reading the functionality of every module or the proposed system.

User Interface: User interface incorporates a stay with an earpiece. In Figure 8 it is noticed underneath that the individual should press the catch to control on the stick and second catch to pick the dialect in which one needs to speak with.

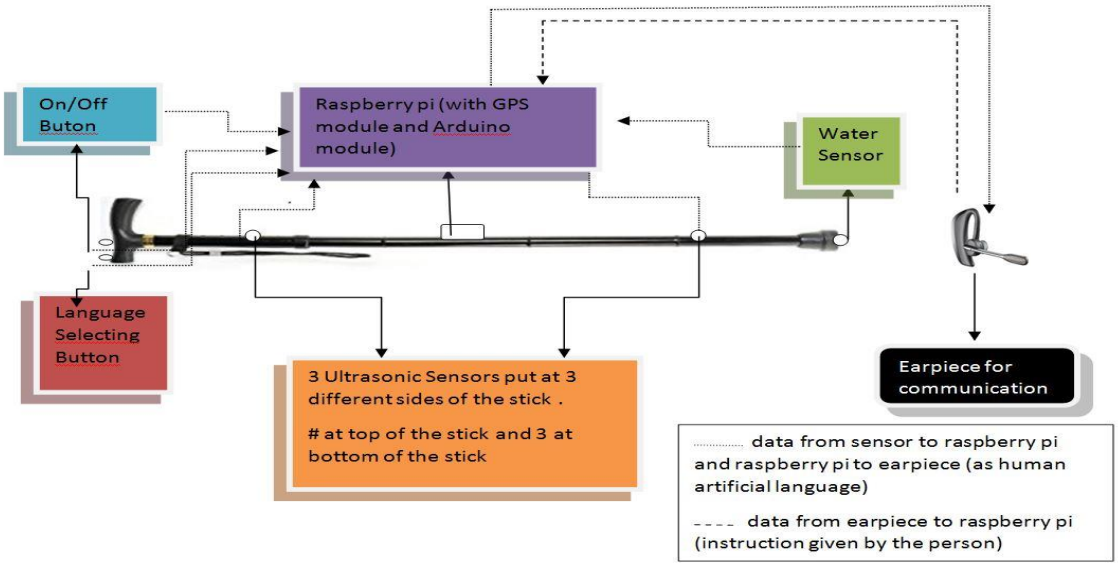

Figure 8: Interface Diagram of the project

4.4 SYSTEM SCREENSHOTS

This area incorporates about the depiction of the working model which are given underneath in the Figure9, Figure10, Figure 11, Figure 12, Figure13.

```
import os
from subprocess import Popen
import wave
from gtts import gTTS

text = "Do you want to go to another location?"

myobj = gTTS(text, lang='en', slow=False)
myobj = gTTS(text=text,lang="en")
myobj.save('welcome.mp3')
os.system("omxplayer welcome.mp3")

def run(runfile):
    with open(runfile,"r") as rnf:
        exec(rnf.read())


import time
time.sleep(2)


print("recording....")

os.system('arecord -f dat -d 15 -D plughw:0,0 test.wav')

print("finish recording...")
#os.system('aplay -f dat test.wav')

import speech_recognition as sr

audio_file = ("test.wav")
r = sr.Recognizer()
with sr.AudioFile(audio_file) as source:
    audio = r.record(source)

try:
    print("audio file contains:" + r.recognize_google(audio))
except sr.UnknownValueError:
    print("Could not understand")
except sr.RequestError as e:
    print("google failed")

s=r.recognize_google(audio)
```

```
import nltk
from nltk.corpus import stopwords
from nltk.tokenize import sent_tokenize,word_tokenize
from nltk.stem import PorterStemmer

#stopwords=set(stopwords.words("english"))

list1=s.lower()
print(list1)
word = nltk.tokenize.word_tokenize(list1)
sents = nltk.tokenize.sent_tokenize(list1)
#words= word.lower()
s1 = "yes"
s2 = "no"
for w in word:
    if(w == s1):
        #os.system('python hindi_file.py')
        run("navigation.py")
    elif(w == s2):
            #os.system('python english_file.py')
        run("obstacle.py")
    else:
            #print("not selsected")
        run("obstacle.py")
```

Figure 9: System Screenshot-I.

```
import os
import RPi.GPIO as GPIO
import threading
import time
from gtts import gTTS

def sonic_one():
    GPIO.setmode(GPIO.BCM)

    TRIG = 23

    ECHO = 24

    #print ("Distance 1 Measurement In Progress")

    GPIO.setup(TRIG,GPIO.OUT)

    GPIO.setup(ECHO,GPIO.IN)

    GPIO.output(TRIG, False)

    #print ("Waiting For Sensor1 To Settle")

    time.sleep(2)

    GPIO.output(TRIG, True)

    time.sleep(0.00001)

    GPIO.output(TRIG, False)

    while GPIO.input(ECHO)==0:

      pulse_start = time.time()

    while GPIO.input(ECHO)==1:

      pulse_end = time.time()

    pulse_duration = pulse_end - pulse_start

    distance = pulse_duration * 17150

    distance = round(distance, 2)

    GPIO.cleanup()
    return distance

def sonic_two():
    GPIO.setmode(GPIO.BCM)

    TRIG2 = 17

    ECHO2 = 18

    #print ("Distance2 Measurement In Progress")

    GPIO.setup(TRIG2,GPIO.OUT)

    GPIO.setup(ECHO2,GPIO.IN)

    GPIO.output(TRIG2, False)

    #print ("Waiting For Sensor 2To Settle")

    time.sleep(2)

    GPIO.output(TRIG2, True)

    time.sleep(0.00001)

    GPIO.output(TRIG2, False)

    while GPIO.input(ECHO2)==0:

      pulse_start2 = time.time()

    while GPIO.input(ECHO2)==1:

      pulse_end2 = time.time()

    pulse_duration2 = pulse_end2 - pulse_start2

    distance2 = pulse_duration2 * 17150

    distance2 = round(distance2, 2)

    #print ("Distance2:",distance2,"cm")

    GPIO.cleanup()
    return distance2
```

Figure 10: System Screenshot-II

```
import requests
import json
import re
import time

mytext2 = "Where do you want to go?"
from gtts import gTTS
myobj = gTTS(text=mytext2,lang="en",slow=False)
myobj.save('welcome.mp3')
os.system("omxplayer welcome.mp3")


print("recording....")

os.system('arecord -f dat -d 15 -D plughw:0,0 test.wav')

print("finish recording...")
#os.system('aplay -f dat test.wav')

import speech_recognition as sr

audio_file = ("test.wav")
r = sr.Recognizer()
with sr.AudioFile(audio_file) as source:
    audio = r.record(source)

try:
    print("audio file contains:" + r.recognize_google(audio))
except sr.UnknownValueError:
    print("Could not understand")
except sr.RequestError as e:
    print("google failed")

s=r.recognize_google(audio)


import nltk
#from nltk.corpus import stopwords
from nltk.tokenize import sent_tokenize,word_tokenize
from nltk.stem import PorterStemmer

#stopwords=set(stopwords.words("english"))

list1=s.lower()
words = nltk.tokenize.word_tokenize(list1)
sents = nltk.tokenize.sent_tokenize(list1)
#content=[i for i in words if i not in stopwords]
```

```
import requests
import json
import re
import time

mytext2 = "Where do you want to go?"
from gtts import gTTS
myobj = gTTS(text=mytext2,lang="en",slow=False)
myobj.save('welcome.mp3')
os.system("omxplayer welcome.mp3")


print("recording....")

os.system('arecord -f dat -d 15 -D plughw:0,0 test.wav')

print("finish recording...")
#os.system('aplay -f dat test.wav')

import speech_recognition as sr

audio_file = ("test.wav")
r = sr.Recognizer()
with sr.AudioFile(audio_file) as source:
    audio = r.record(source)

try:
    print("audio file contains:" + r.recognize_google(audio))
except sr.UnknownValueError:
    print("Could not understand")
except sr.RequestError as e:
    print("google failed")

s=r.recognize_google(audio)


import nltk
#from nltk.corpus import stopwords
from nltk.tokenize import sent_tokenize,word_tokenize
from nltk.stem import PorterStemmer

#stopwords=set(stopwords.words("english"))

list1=s.lower()
words = nltk.tokenize.word_tokenize(list1)
sents = nltk.tokenize.sent_tokenize(list1)
#content=[i for i in words if i not in stopwords]
```

Figure 11: System Screenshot-III

Figure 12: System Screenshot-IV

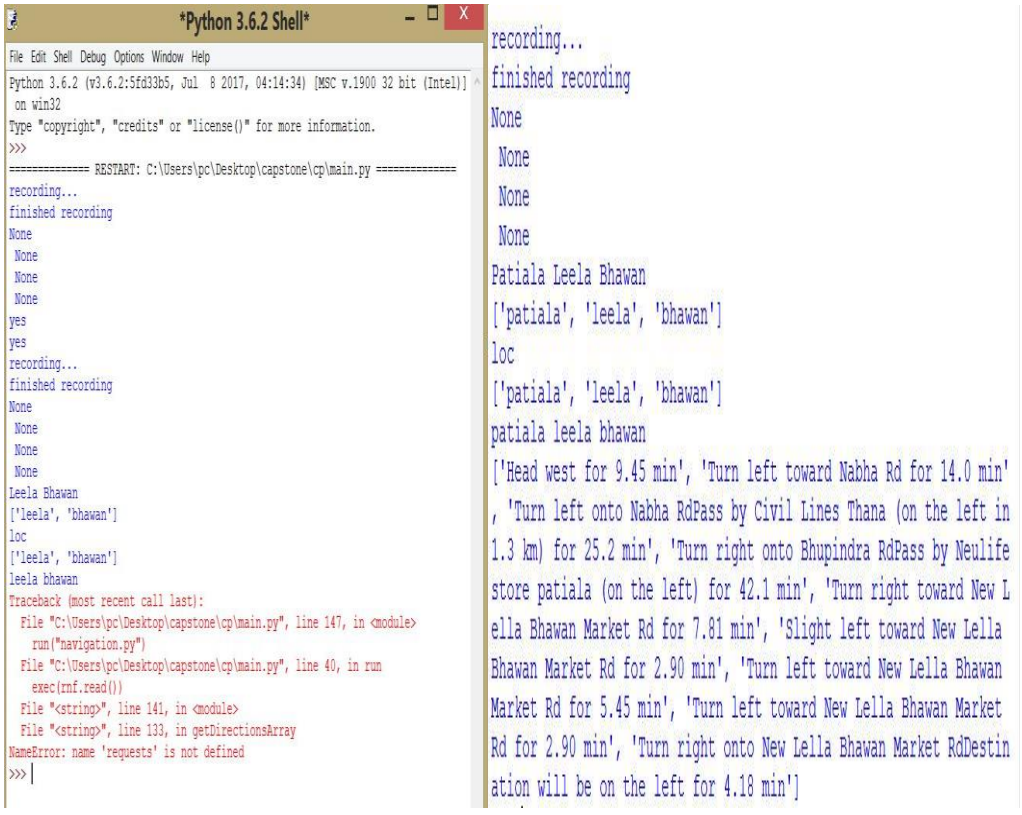

Figure 13: System Screenshot-V

IMPLEMENTATION AND EXPERIMENTAL RESULTS

This segment depicts the execution of the undertaking. The different setup utilized and the test plan, test cases, and results are talked about underneath.

5.1 EXPERIMENTAL SETUP

This segment depicts the execution of the venture. The different setup utilized and the test plan stick is an installed framework, which directs a discussion in normal dialect by means of sound-related techniques, comprehends the guidelines of the client and react as per the circumstance. An Intelligent stick needs to the reaction about the deterrent that may come in the client way. The Intelligent stick likewise needs to the reaction about the headings when requested the route to a given area. The significant destinations, having the capacity to identify the obstruction and help in the route to the given area through the AI directions. Presently in the wake of preparing, we have to check the usefulness of these two goals. Along these lines, to hold under control with the advancement and results up until now, the equipment and programming were implanted into one setup and experimentation was done to test the stick for hindrance identification and to assess our work up until this point. Our normal outcome is a stick that attempts to identify the snags and help in the route. n, test cases, and results are examined underneath.

Contraption required: Raspberry Pi, Wi-Fi, PC, speakers, mouthpiece, USB, ultrasonic sensors, GPS tracker.

Methodology: The Raspberry Pi is associated with a charging point. The ultrasonic sensors, GPS and mouthpiece are associated with the association focuses gave on the Pi. The workstation is associated with the Pi through puTTy. The Raspberry Pi has a Wi-Fi module in-assembled.

5.2 EXPERIMENTAL ANALYSIS

Below are the sections which have detailed discussion about the complete experimental analysis of our project.

5.2.1 PERFORMANCE PARAMETERS

The parameters for the assessment of the astute stick are same as an installed framework. Here, the framework should recognize the impediments and help the client explore his/her area.

i. **Appreciation abilities:** The stick must be sufficiently proficient to comprehend and fathom the inquiries of the client and even comprehend the client even its not syntactically right. The stick must be keen enough to identify the obstructions and when asked ought to likewise give the way for the route.
ii. **Scalability:** The cane must be scalable to different work regardless of the environment.
iii. **Speed:** The cane must be quick enough to detect obstacles and must not take forever to detect the obstacle and defining path for navigation.
iv. **Accuracy:** It is a major aspect for an intelligent-stick, as this what the cane is all about as to how close it is to fulfill its objective of detecting the obstacle.
v. **Reliability:** The cane should be reliable for navigation as the users should reach to location entered by them.
vi. **Portability:** the cane can be carried easily from one place to another.

5.3 TESTING PROCESS

The section includes various test plan, test cases and results. The various strategies are listed below in this section.

5.3.1 TEST PLAN

The test plan was designed in a way, so we stayed in close agreement to our objectives and performance parameters.

5.3.1.1 FEATURES TO BE TESTED

- Navigation: Being a cane, it must define the map for desired locations.
- Object Detection: The stick needs to be aware of its surroundings and must be able to identify objects near it when necessary.
- Map API: The system should respond for the map when the destination is asked.
- Ear to Stick (speech-to-text): The system should be able to convert the audio to text.

- Ear to Stick (text-to- speech): The system be able to issue the AI commands.

Test Cases: In PC equipment and programming advancements, testing is utilized at key checkpoints in the general procedure to decide if targets are being met. Here, to test the proposed framework, different testing had been produced using the unit to a combination that has been alluded to in a Table 9.

Table 9: Test case of the proposed system

Test Case No.	Module	Sub Module	Type of test	Testing Criteria	Test Steps	Testing Data	Expected Result	Actual Result	Result
TC-1	Speech Processing	Speech to Text Conversion	Input Based (Data in the form of voice which is given by user)	Speech given by the speaker should be correctly converted into text.	The code is tested by 10 different speeches by 10 different users.	Voice of the user.	Right text is printed corresponding to the speech given by the user.	Exact corresponding to the speech given by the user is obtained.	PASS
TC-2	Speech Processing	Text to Speech conversion	Input Based (Data in the form of text which is entered by the user)	Text entered by the user should be correctly converted into speech and correctly spoken by the artificial voice.	The code is tested is with 10 different text with 10 different users.	Text entered by the user.	Right speech is given by an artificial voice for the text entered by the user.	The text entered by the user is exactly converted into the speech and was spoken by artificial voice.	PASS
TC-3	Speech Processing	Noun Extraction from the text.	Input Based (Data in the form of text or voice entered or spoken	The entered text or voice (converted into the text first) pools out	Code is tested for 10 different types of text and corresponding	Text or Voice entered by the user.	Proper nouns were extracted for the corresponding text.	All the proper nouns present in the text were	PASS

			by the user)	the proper noun from the text.	nouns are generated from it.			shown as the output .	
TC-4	Obstacle detection	For single ultrasonic sensor	Functionality	The ultrasonic sensor is able to detect obstacle within distance of 1.5 m and distance between obstacle and sensor is shown to the computer.	The hardware and software testing are checked by providing obstacle to sensors at different distance and corresponding distance is displayed.	NA	The sensor should detect and the corresponding distance is displayed	The ultrasonic sensor worked well and corresponding distance was displayed.	PASS
TC-5	Obstacle detection	For two ultrasonic sensor	Functionality	The ultrasonic sensor is able to detect within given range 1.5 m and the ultrasonic sensor with less distance to obstacle should beep first.	This is tested by providing obstacle to two sensors at different distance from the obstacle at same time with priority given to sensor which detect the obstacle at small distance from sensor.	NA	The sensor should detect obstacles and the sensors which has small distance from obstacle should beep first.	The sensor the obstacle and the right sensor was beeped and corresponding distance was displayed.	PASS
TC-06	Obstacle detection	For 3 ultrasonic sensor	Functionality	The three ultrasonic sensor is able to detect obstacle within range of 1.5m and	This is tested by providing obstacle to three sensors at different range at same time	NA	The sensors should detect obstacles and the sensors which has small	The sensor the obstacle and the right sensor was	PASS

				the ultrasonic sensor with less distance to obstacle should beep first.	with priority given to sensor which detect s the obstacle at small distance from sensor.		distance from obstacle should beep first..	beeped and corresponding distance was displayed.	
TC-07	Obstacle Detection and Speech Processing	Pooling the output of obstacle detection using ultrasonic in the form of artificial voice.	Functionality	The obstacle detection module detects the obstacle and pools the output in the form of artificial voice.	The software and hardware code is tested by providing obstacles in front of all the sensors and pooled the output in form of artificial voice	NA	The result should be correct distance should be spoken by the artificial voice for the sensor which is at the least distance from the obstacle.	The speech module worked well and sensor which had the least distance with obstacle was pooled as voice.	PASS
TC-08	Earpiece-pi Communication	Testing of mic	Functionality	It is the testing of mic to check whether it was taking right input in the form of voice from the user.	Tested this by providing voice to mic and checked whether it was taking right voice by using NLP modules by outputting it in the form of text.	Voice (Given by the user)	The mic should take the right voice and should generate the right text for the given voice.	Mic took the right speech and corresponding right text was generated..	PASS
TC-09	Earpiece-pi	Testing of earpiece	Functionality	Testing of earpiece to check	Tested this by entering	Text (Entered by the	The earpiece should	The earpiece was	PASS

	communication			if the right artificial voice was pooled .	text and checked whether right speech was generated for the corresponding text.	user)	pool the artificial voice for the corresponding text entered by the user.	working well for the corresponding text.	
TC-10	Earpiece-pi communication	Testing of Raspberry-Pi	Functionality	Testing of Raspberry-pi by configuring it with the Putty and making it the operating system of the stick by installing Raspbion.	Tested this by configuring it with mobile hotspot via putty.	NA	The Raspberry-pi should work well for a single internet connectivity.	The raspberry-pi was working well.	PASS

5.4 RESULTS AND DISCUSSIONS

The stick, of course, begins speaking with the individual through NLP additionally begins giving a route to the individual through GPS tracker. The stick is presently ready to distinguish different hindrances in route with the assistance of ultrasonic sensor in spite of the fact that we need to constrain our task to the main dialect rather than bilingual as the library utilized for it isn't working legitimately and appropriate web association is the central point in the best possible working of the stick as far as speed and in addition taking care of the issue of jitter.

5.5 INFERENCES

In view of the outcomes, we gathered that the task can be reached out to multilingual in the coming occasions. The execution of the stick can likewise be expanded by giving a question recognition module through picture preparing that will help in better imagining the earth to the outwardly impeded individual. The stick execution can likewise be expanded by utilizing nearness sensors. The stick execution can likewise be expanded by

expanding the effectiveness of NLP modules to such an extent that it can recognize our voice just instead of the clamor of the earth.

5.6 VALIDATION OF OBJECTIVES

The validation of all the objects discussed before in the report are described below in Table 10. It contains the result for the validation of objectives through which it describes the status whether the objective is fulfilled or not.

Table 10: Validation of Objectives

S. No.	Objectives	Status
1	To extend the use of English corpus as an application of Natural Language Processing.	Successful
2	To convert text to speech and vice-versa with the help Speech Recognition and Natural Language Processing.	Successful
3	To detect the obstacle using ultrasonic sensors.	Successful
4	To interface different sensor with each other and build communication between stick and earpiece.	Successful
5	To Navigate using map API interface.	Successful

CONCLUSIONS AND FUTURE DIRECTIONS

In this section the future directions of the project are discussed. The social environmental benefits to the society are highlighted.

6.1 CONCLUSIONS

Till now the model is finished with two modules which contain how to recognize an obstruction with ultrasonic sensor (essentially the nearness is checked till now) and NLP Module which contains Speech to content and content to discourse change, interpretation of one dialect to other likewise extraction of things has been done in light of the fact that for route just thing extraction is required.

6.2 ENVIRONMENTAL, ECONOMIC AND SOCIETAL BENEFITS

Visual impairment, visual impedance, and vision misfortune impacts affect people encountering such inabilities. Conveying these inabilities with them mental, social, and monetary results. Consequently, affecting the personal satisfaction and denying such people of performing a considerable lot of the Activities of day by day life, the most urgent of which is route and versatility. Visual impairment likewise alludes to the individuals who have so little vision that they need to depend subject to different faculties on as vision substitution aptitudes.

Visual deficiency can be characterized as the state or state of being not able to see or see. It very well may be by birth, damage or some infection. Such inability presents incredible difficulties in the individual's everyday exercises. It frustrates speed and additionally profitability.

Our stick is basic for recognition of impediments/questions before the outwardly weakened individuals likewise explores additionally the proposed framework is minimal effort, which is a critical factor on the grounds that 90% of the outwardly debilitated on the planet lead their lives in low pay. This framework changes the nature of outwardly impairer's life and declines reliance on others for their public activity. The visually impaired people accomplish certainty and authority over their life

6.3 REFLECTIONS

Through the work done by the individuals from the venture, the learning is investigated in the area of NLP and how to interface a little equipment with raspberry pie and check the approval of our undertaking. The information reinforces numerous folds as far as NLP and furthermore about the equipment utilized by us in the model as for how we code them essentially and how to create correspondence among every part. Since we get a wide thought regarding NLP and Hardware interface, now we as a whole our endeavor to upgrade our insight in future to get a more extensive view about the equivalent and enhance the stay with our insight.

6.4 FUTURE WORK

The intelligent-stick functions admirably to offer help to the outwardly debilitated. The future work anticipates the wise stick are made reference to underneath:

- In future the utilization of the proximity sensors, which will enable the sensors to give an exact outcome.
- The framework will utilize Pi-camera, will help in the impediment location and will perceive the snaps. It will build the precision of the framework.

PROJECT METRICS

In this section it is described about the project metrics where in all the challenges faced and about the project is described below.

7.1 CHALLENGES FACED

While doing this project lots of challenges were faced by the team. The challenges which were faced during the project are as follows:

i. **Initial Challenges:** The real test was looked by the group when the task thought must be chosen a considerable measure of writing overview must be done to think of an exceptional and impactful thought which will attempt to help an uncommon area of the general public.

ii. **Implementation Challenge:** At the point when the usage of the undertaking has been begun then a great deal of difficulties looked by the group like equipment challenge, programming difficulties, and mix test.

- **Hardware Challenge:** First equipment challenge was looked by the group when the undertaking has been begun it is hard to discover fitting equipment which ought to be utilized in the venture to play out a particular errand because of cash imperative and time requirement. The second test was confronted while there has sufficient energy to utilize a raspberry pi. As bunches of endeavours must be put by the group to comprehend about raspberry pi, how to design it, pins of pi and diverse parts of the pi. The third test was confronted while utilizing the GPS tracker as it has been extremely hard to see how to continue further utilizing it in the venture.
- **Software Challenge:** In this part, while composing the code numerous difficulties were looked as libraries which were utilized are not introduced in pi and numerous interchanges must be found to make it work legitimately. The significant test is that when the google trans isn't attempting to interpret the dialect and this test is remained the test and not ready to unravel by the group.

- **Integration Challenge:** This test is confronted while the coordination must be done of various records, programming with equipment and one module with an alternate module.

iii. **Testing Challenge:** After the consummation of the venture, the significant grouping of the group redirected to test the last item and correct it to make it mistake free however much as could be expected. In any case, the test is that to consider different experiments on which the mistake must be checked to make stick as exact as would be prudent.

iv. **Report making Challenge:** Aside from coding, equipment, and programming joining move one of the significant difficulties were to make the blunder free report. Be that as it may, this area encourages the group to find out about how to show the function in one archive to give the perception to the client how the venture is done and moved to the fulfilment arrange.

v. **Team Related Challenge:** No test was faced with colleagues as all are especially from the beginning about the venture. Correspondence, and additionally the working of each member, is admirable and on account of which the result of the task is productive.

vi. **Project Related Challenge:** While doing this venture many test and suppositions were taken in the culmination of it which ought to be there as this is the continuous situation the undertaking is about. The significant reason is the cash imperative and additionally the issue of libraries which are not open to understudies.

Every one of the difficulties was settled with the assistance of the regarded tutors and the ceaseless endeavours by the group in getting the hang of, executing new ideas. Likewise, by finding the substitute approaches to the different issues coming in the way while the venture is actualizing.

7.2 RELEVANT SUBJECTS

The subjects which are relevant to this project that had been described in Table 11. It covers the course curriculum of B.E Computer Science are Software Engineering, Natural Language Processing (NLP), Embedded System Design and Engineering Designing-III.

Table 11: Subject Code and Subject Name

Subject Code	Subject Name	Description
UCS503	Software Engineering	This subject helps a considerable measure while planning the model of the item, necessity gathering, writing a survey, a graph for undertaking usage, a creation of experiments and report making. All the previously mentioned things can finish due to this subject.
UTA011	Engineering Design-III	With the assistance of this subject the coding of ultrasonic sensors were done which are utilized in deterrent recognition. This subject aides in the learning of how to incorporate an alternate sort of equipment items with one another without having obstruction among one another.
UCS614	Embedded System Design	With the assistance of this subject, the possibility of the undertaking is picked through which the primary inspiration was that to assist the general public with the assistance of new innovation. As nowadays the Internet is all the more principally utilized in each registering gadget which is empowering them to send and get information or concentrate data or to play out some activity utilizing that data or information. In this undertaking, the distinctive sorts of equipment are utilized which were incorporated among one another to play out a particular errand with the assistance of web which is utilized as the mode of correspondence between the client and the equipment framework. Equipment items which are utilized in this undertaking are Ultrasonic Sensors, GPS tracker and Raspberry Pi. Raspberry Pi is utilized as the PC through which the preparing is done and the code is composed in Python dialect which is additionally the piece of the course educational programs. GPS tracker is utilized for exploring from one place to other and Ultrasonic Sensors are utilized for obstruction location and NLP modules are utilized for discourse acknowledgment which utilizes the web association with make correspondence conceivable between equipment items and the client.
UML602	Natural Language Processing (NLP)	This subject is identified with the field that especially worries with the interlingual correspondence between the PC and human or endeavours to make PC to take in the common dialects named as English, Hindi, Spanish and so on. This subject assumes a noteworthy job in the fulfilment of this venture similarly as with the assistance of NLP, the discourse acknowledgment module which comprises of transformation of discourse to content and the other way around is conceivable, because of which the client can speak with the stick and the stick is going about as someone else to the client which assist the client with guiding while at the same time strolling out and about.

7.3 INTERDISCIPLINARY KNOWLEDGE SHARING

Apart from using knowledge gained through subjects which had been taught in the course curriculum. The team has gained a lot of information as well as knowledge from other source which are required in the completion of this project. The various other disciplinaries which are included in this project are regarding the usage of Raspberry Pi and its integration with different kind of hardware products like ultrasonic sensors and GPS tracker. The team majorly learned how to use, configure, code and reboot Raspberry pi also its integration with different kind of hardware products which has been the main reason in the completion of this project.

Other major knowledge gained by the team is how to use GPS tracker. Major learning in this disciplinary was the coding part in which obstacle detection, speech module and GPS mapping coding had to be integrated for the final working of the stick. Through the above knowledge all the team members were gained lot of knowledge in different kinds of disciplinary which help in the completion of the project successfully.

7.4 PEER ASSESSMENT MATRIX

Write the name of each of your group members in a separate column. For each person, indicate the extent to which you agree with the statement on the left, using a scale of 1-4 (1=strongly disagree; 2=disagree; 3=agree; 4=strongly agree). Following are the tables mentioned below in Table 12, Table 13, Table 14, Table 15.

Table 12: Peer assessment by Mili Supreet

Evaluation Criteria	Group member: (Parika Gupta 101510055)	Group member: (Ritwik Agrawal 101510067)	Group member: (Mili Supreet 101510095)	Group member: (Ishita Parmar 101690005)
Attends group meetings regularly and arrives on time.	3	3	4	4
Contributes meaningfully to group discussions.	3	4	3	3
Completes group assignments on time.	3	3	4	4
Prepares work in a quality manner.	4	3	3	4
Demonstrates a cooperative and supportive attitude.	4	4	4	4
Contributes	3	4	4	3

significantly to the success of the project.				
TOTALS	20	21	22	22

Table 13: Peer assessment by Ishita Parmar

Evaluation Criteria	Group member: (Parika Gupta 101510055)	Group member: (Ritwik Agrawal 101510067)	Group member: (Mili Supreet 101510095)	Group member: (Ishita Parmar 101690005)
Attends group meetings regularly and arrives on time.	3	3	4	4
Contributes meaningfully to group discussions.	3	4	3	3
Completes group assignments on time.	3	3	4	4
Prepares work in a quality manner.	4	3	3	4
Demonstrates a cooperative and supportive attitude.	4	4	4	4
Contributes significantly to the success of the project.	4	4	4	3
TOTALS	21	21	22	22

Table 14: Peer assessment by Ritwik Agrawal

Evaluation Criteria	Group member: (Parika Gupta 101510055)	Group member: (Ritwik Agrawal 101510067)	Group member: (Mili Supreet 101510095)	Group member: (Ishita Parmar 101690005)
Attends group meetings regularly and arrives on time.	3	3	4	4
Contributes meaningfully to group discussions.	3	4	3	3
Completes group assignments on time.	3	4	4	3
Prepares work in a quality manner.	4	4	3	4
Demonstrates a cooperative and supportive attitude.	4	4	3	4
Contributes significantly to the success of the project.	4	4	3	3
TOTALS	21	22	22	21

Table 15: Peer assessment by Parika Gupta

Evaluation Criteria	Group member: (Parika Gupta 101510055)	Group member: (Ritwik Agrawal 101510067)	Group member: (Mili Supreet 101510095)	Group member: (Ishita Parmar 101690005)
Attends group meetings regularly and arrives on time.	3	3	4	4
Contributes meaningfully to group discussions.	4	4	3	3
Completes group assignments on time.	3	3	3	4
Prepares work in a quality manner.	4	4	3	4
Demonstrates a cooperative and supportive attitude.	4	3	4	3
Contributes significantly to the success of the project.	4	4	4	3
TOTALS	22	21	21	21

Ques1: How effectively did your group work?

Ans: As a gathering, team as a whole co-operated for the effective finish of the undertaking. In spite of the fact that team confronted different challenges in the working up of different modules now and again, with gathering discourses, team discovered the arrangements. Team constantly finished our assessments on time with the work being partitioned similarly. Team likewise grew delicate abilities like collaboration, authority.

Ques2: Were the behaviors of any of your team members particularly valuable or detrimental to the team? Explain.

Ans: No, fairly it was steady of where everybody functioned as a period not just as an individual part.

Ques3: What did you learn about working in a group from this project that you will carry into your next group experience?

The group project is completing task viably fairly, simple as a part. Aside from task learnings, we adapted delicate abilities like participation, initiative, discipline.

7.5 ROLE PLAYING AND WORK SCHEDULE

The roles played by each member of the group are as follows:

i. Ishita Parmar: Obstacle detection module. From making of circuit to the coding of that module.

ii. Mili Supreet: Integration of software and hardware and provide communication among them.

iii. Parika Gupta: Speech recognition module consists of text to speech and vice versa.

iv. Ritwik Agrawal: Map API module and navigation. From making of circuit to coding of that full module.

The work schedule of the project is mentioned below in Table 16.

Table 16: Project Schedule

S No.	Activity	Starting Date	Ending Date
1	Identification, Formulation & Planning	30-Jan	10-Feb
2	Literature survey and requirement gathering	11-Feb	28-Feb
3	obstacle detection module	01-Mar	28-Mar
4	Natural language processing module	29-Mar	15-May
5	Map-API interfacing module	16-May	16-Jun
6	Stick to ear-piece communication module	17-Jun	30-Jul
7	Navigation module	01-Aug	05-Sep
8	Interfacing s/w and h/w	06-Sep	25-Sep
9	Final testing	26-Sep	30-Oct
10	Final submission	01-Nov	25-Nov

7.6 STUDENT OUTCOMES (A-K MAPPING)

A-K mapping are a way to centre around particular desires for a program. They encourage educational modules conveyance systems and appraisal methodology. There is a vital initial step that must precede the improvement of execution markers, and that is choosing understudy results. Outcomes are all described below in Table 17.

Table 17: A-K Mapping

SO	Description	Outcome
A1	Applying mathematical concepts to obtain analytical and numerical solutions.	Used basic principle of mathematics to calculate the distance from the values coming from the sensors.
A2	Applying basic principles of science towards solving	Basic principles of science like which

	engineering problems.	will be best sensor is chosen for a situation which help in solving the engineering problems
A3	Applying engineering techniques for solving computing problems.	Natural Language Processing, Embedded System and coding all the engineering techniques are applied to solve the computing problems effectively.
B1	Identify the constraints, assumptions and models for the problems.	Constraint, Assumptions as practicality as far as expense and web availability
B2	Use appropriate methods, tools and techniques for data collection.	Speech recognition is the library used for collecting human voice from mice and Raspberry pi is used to transmit the data from sensors as well as from GPS. NLP and IOT are the techniques used in this project.
B3	Analyze and interpret results with respect to assumptions, constraints and theory.	In light of the nature of the sensors the outcomes were very palatable.
C1	Design software system to address desired needs in different problem domains.	Utilized an implanted framework where discourse preparing goes about as the UI and the backend as raspberry pi.
C2	Can understand scope and constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.	This thing is made by considering to energize the old and outwardly disabled people to have a secured space while walking around and about.
D1	Fulfill assigned responsibility in multidisciplinary teams.	Two teams are divided in which when two people working on the practical implementation of project other will take care about the making of the report.
D2	Can play different roles as a team player.	All team member played different roles when required as coder, tester, requirement gatherer, writer etc.
E1	Identify engineering problems.	While coding lots of problems were there and are recognizable and solved in mean time as well.
E2	Develop appropriate models to formulate solutions.	Prototype building is required to get a clear vision about the project.
E3	Use analytical and computational methods to obtain solutions.	While taking values from GPS modules analyses were done to get what values for this project.
F1	Showcase professional responsibility while interacting with peers and professional communities.	In the assessment, the undertaking is exhibited exceptionally well and every one of the inquiries of the specialists have addressed properly.
F2	Able to evaluate the ethical dimensions of a problem.	It is the little scale venture which is based for a unique space of people particularly outwardly weakened.
G1	Produce a variety of documents such as laboratory or project reports using appropriate formats.	The diagrams, documents, SRS and the report all are created as per the formats given on the website.
G2	Deliver well-organized and effective oral presentation.	The product is presented by the

		means of showing the prototype, video of the prototype and with the help of a presentation in the evaluations which also explaining all the features and working of the stick efficiently to the panel.
H1	Aware of environmental and societal impact of engineering solutions.	The product is created a positive impact on the environment and society by making the person independent of others.
H2	Examine economic tradeoffs in computing systems.	Using raspberry pi has reduced our cost to a much lower extent as it serves various purposes that can be accomplished by multiple items. Further comparisons of different components on various online portals is also crucial.
I1	Able to explore and utilize resources to enhance self-learning.	The team has used Tutorials courses, YouTube videos and various websites during the learning and development phase.
I2	Recognize the importance of life-long learning.	Team work, accomplishing work in limited time, presentation skills, technical skills, dealing with various errors with patience will help the team in future.
J1	Comprehend the importance of contemporary issues.	To make the person self-dependent not the liability on the society is reduced by this product.
K1	Write code in different programming languages.	Only Python language is used to code the project.
K2	Apply different data structures and algorithmic techniques.	Natural Language processing techniques, Threading concepts and algorithms are used along with various data structures.
K3	Use software tools necessary for computer engineering domain	Raspbian OS and python3 ide are used.

7.7 BRIEF ANALYTICAL ASSESSMENT

Q1. What sources of information did your group explore to arrive at the list of possible Project Problems?

Ans: The group was aware to the understanding of the Capstone requirement and some of problems that needs to explore. Team explored the literature mostly the Technical journals and Technical magazines from IEEE. The interfacing issues have been refreshed through textbooks or internet resources. However, the scope has been decided after consulting our supervisor.

Q2. What analytical, computational and/or experimental methods did your project group use to obtain solutions to the problems in the project?

Ans: Constructing a simple and cost-effective Automated Stick was the most challenging task with obstacle detection, navigation, voice recognition and software plus hardware compatibility. We have integrated various modules of obstacle detection, navigation, voice etc. into a single system.

Q3. Did the project demand demonstration of knowledge of fundamentals, scientific and/or engineering principles? If yes, how did you apply?

Ans: In this technical project, we have used the principles of Natural Language Processing and Internet of Things. Other skills used are Hardware and software integration techniques. Design, architecture and documentation principles were taught in the subjects Software Engineering and Software Design and Construction.

Q4. How did your group shares responsibility and communicate the information of schedule with others in team to coordinate design and manufacturing dependencies?

Ans: The team of four members divided the project into subtasks, individual taking one subtask at a time. Slack a free online project management tool was used to assign tasks, deadlines and for other communication and coordination.

Q5. What resources did you use to learn new materials not taught in class for the course of the project?

Ans: The team took various online tutorials and refer to web for explore more about the topics on which we are working upon. Various courses on You tube for learning how to make circuits and their implementation were referenced and read multiple papers and technical reports on IEEE to learn new materials not taught in class.

Q6. Does the project make you appreciate the need to solve problems in real life using engineering and could the project development make you proficient with software development tools and environments?

Ans: The project addresses a real-life problem using engineering. Working on this project has made the group appreciate the need to solve real world problems and has motivated the team to take up new problems in diverse fields. The group were introduced to various new technologies like NLP, map API coding and various Python libraries.

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