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Internet of Things (IoT) based Mobility Service for Visually Impaired

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Abstract: **— Internet of Things (IoT) is the inter-connection of things through Internet along with the wireless technologies such as Radio-Frequency Identification (RFID). The independent mobility for Visually Impaired (VI) people is very difficult in this growing world and they depend upon different travelling guide which are cumbersome. The aim of this paper is to provide a better understanding of surroundings and motivate VI person to live more independently in their routine-life by using Internet of things. This paper considered different locations. These locations are attached with the RFID tag at the entrance. VI person is provided smart phone and RFID reader which is interfaced with ARM7 (Advanced RISC Machines) microcontroller. If VI person wants reach any of the location, then he/she speaks (audio signal) to the smart phone about the location they want to reach. The navigational information (audio) is extracted from the server of the Internet and information regarding obstacle on the path is also informed to aid VI to reach the destination. The Server of the Internet has the navigational data base to reach the location. The navigational data is provided only to an authenticated person. The RFID reader which is available with VI, identifies the tag attached to the location and announces the destination location name.**

Keywords**—Internet of Things; ARM7; Smartphone; Voice recognition**

I. INTRODUCTION

Visually impaired face imperatives in autonomous portability and route. Portability implies the likelihood of generously moving, without backing of any supplementary individual, at home and new situations. Individuals with visual weakness tackle colossal restrictions regarding versatility. A framework which guide or help individuals with vision misfortune, going from somewhat sight to thoroughly visually impaired, by method for sound charges is alluded as Route help for outwardly weakened (NAVI) [1].

The most seasoned and customary versatility helps for individual with visual weaknesses are the strolling stick (additionally called white stick or stick) and guide canines. The disadvantages of the strolling stick is that it get stuck in each split of the asphalt, in the event that it has a roller tip, the roller gets stopped up with soil from floor and gets stuck and guard dogs has almost no data passed on . With the fast advances of present day innovation, both in equipment and programming front can possibly give wise route abilities. To distinguish the position and introduction and area of the Visually impaired individual any of those arrangements depend on Global Positioning System (GPS) innovation [2]. GPS is a radio route framework that permits area, ocean and airborne clients to decide their definite area, speed and time 24 hours a day, in all climate conditions, anyplace in the world. GPS hardware is generally utilized as a part of science and has now turned out to be adequately minimal effort so that just about anybody can claim a GPS collector. The IoT alludes to the always developing system of physical articles that component an IP address for Web availability, and the correspondence that happens between this items and other Web empowered gadgets and frameworks which is inserted with hardware, programming, sensors, and system network that empowers these items to gather and trade information.

II. LITERATURE SURVEY

Some of the related works to build navigation system for visually impaired people are as follows: The paper [1] demonstrates the value of IoT infrastructure and web APIs for effective smart phone-based travel aids by developing three different Location-Based Services. Internet of Things as discussed in [2] denotes “an Internet application sharing the things information in the whole world”. The demonstrated development of Talking Transit by combining open data and IoT [3]. To provide feasible travel guide for blind user by integrated real time localization technologies with the combination of wearable sensors and social sensors is examined in [4]. The fundamental rule qualities for a successful joining of the Web of things in savvy network are talked about in [5]. Joining and expanded personalization inside an IoT savvy environment utilizing just unpretentious sensors is presented in [6]. RFID and IoT technologies are discussed in [7]. The possibility to obtain obstacle avoidance

for assisting visually impaired people discussed in [8].

III. PROPOSED WORK

This section describes the Internet of Things (IoT) Based Mobility Service for Visually Impaired (IOTMSVI) scenario,Block diagram of IOTMSVI,Voice Recognition for authentication and Hierarchy of Services.

A. IOTMSVI Scenario

IOTMSVI Scenario is shown in figure 1 and consistsmainly RFID, Infrared (IR) sensors, Internet (database), Smartphone.RFID is a technology that incorporates the use of electromagnetic or electrostatic coupling in the radio recurrence (RF) bit of the electromagnetic range to extraordinarily distinguish an article, creature, or individual Low-recurrence RFID frameworks (30 KHz to 500 KHz) have short transmission ranges (for the most part under six feet). High-recurrence RFID frameworks (850 MHz to 950 MHz and 2.4 GHz to 2.5 GHz) offer longer transmission ranges (more than 90 feet) in the urban space helps in the collection of information about the surrounding this can be taken as an advantage for the visually impaired specially. An IR sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. IR sensor operates at voltage 5V and it is Sensitivity up to 30cm (Adjustable). It has digital Logic output 0 -5V.

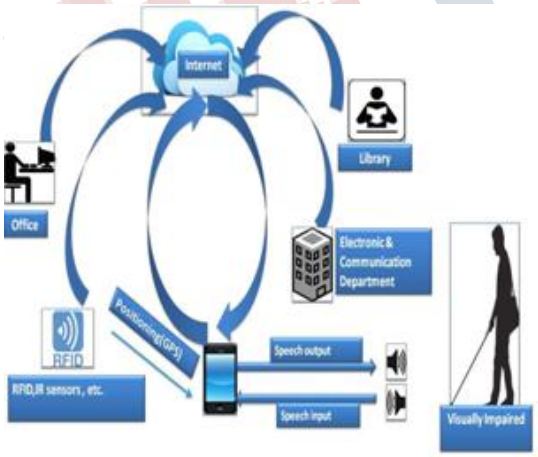

Fig1: IOTMSVI Scenario

Internet (database) is an organized collection of a data. It is collection of schemes, tables, queries, reports, views and other objects. Smartphone is used to give the voice input (destination) and to get back the voice output (navigation).

B. Block Diagram IOTMSVI

The IoT infrastructure play a crucial role in the independent mobility of a visual impaired, here the information regarding the surrounding of a blind person is predefined in the database or the server. Information is gathered using thesensors like RFID deployed in the urban spaces.

Whenever the blind wants to reach a particular destination, he/she gives the name of the destination as voice input to the Smartphone.Voice recognition method is used for the purpose of authentication and also additional hardware along with ARM 7 microcontroller is used to interface RFID reader which is used to identify the object that are attached with tags, along with LCD display, Bluetooth, IR sensor, voltage regulator(IC 7805) and voice play back module as shown in Fig2.

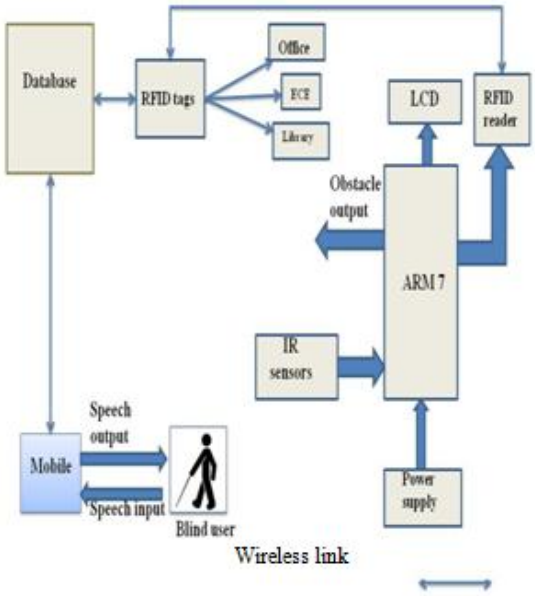

Fig 2: Block diagram IOTMSVI

The ARM7–LP2148 microcontroller is 32-bit RISC microcontroller and CPU consumes 1.8Volts whereas 8051 microcontroller CPU consumes 5 Volts so it is economical to use ARM7 microcontroller.LCD display is used to know the status of the microcontroller.Along with the aim to aid for independent mobility there is the need of prior indication of the obstacle using IR sensors, it has a range of up to 30cm and the sensitivity can beadjusted. Voice play back module operates at 12 Volts it can store up to 8 voice samples and has the facility of voice play back. Through speaker user gives the voice input to the Smartphone for authentication purpose. The user's voice features will be extracted and it will be compared with the reference template which is predefined in the database. If both matches the user will be authorized to access the information. After the successful

authentication VI will be authorized to access the data that he/she required to reach the destination. When the user speaks out the destination through the Smartphone. Then the user should give the destination location to the Smartphone and it checks for the data in the database (stored in server. If the destination information is present in the database then it retrieves the data back to the Smartphone using Internet and it also gives navigational direction details to VI through voice commands.

RFID are attached to the different destinations in the college campus locations such as R&D Lab, HOD Cabin, Principal Cabin, and Library. When VI personarrives within the range of RFID (which are attached to the destination locations) by the aid of navigational directions given by the smartphone, later RFID reader is used to identify the exact object name and the voice output is readout through Smartphone. IR sensors are used for obstacle detection. When a sensor senses the obstacle present on the way of VI it gives the Obstacle information to the ARM 7 and conveys this message through Bluetooth to Smartphone that gives voice output to VI.

C. Voice Recognition for authentication

Voice Recognition for *authentication* is shown in Fig 3.is Used for the authorization of the user. Initially user voice samples for the different locations are saved on to the smart phone as reference template. Whenever it is required the VI user must give voice input. The unique features of the user voice will be compared with the reference template for the similarity check. If both matches then the user can access the information successfully via Internet.

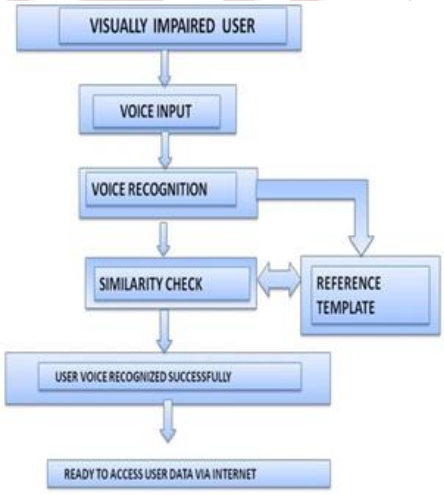

Fig 3: Voice authentication

D. Hierarchy of Services

The working of the IOTMSVI flow diagram is shown in Fig 4. Voice acknowledgment security verification is done to confirm the client after a fruitful login advanced cell perceives the voices, hunt down destination, courses, and give the course to the client through voice. The principal capacity is to inquiry destination through voice acknowledgment and Web. After voice confirmation, clients say the needed destination as per the requirement. If there should arise an occurrence of vague voice, the message saying 'talk again' will appear and clients say the destination afresh obviously. In the event that the application requests affirmation of destination, the clients say, 'yes', if the destination is right. The second capacity is course look into utilizing Web.

After clients have affirmed the destination, the application appears the guide in the wake of hunting down course from the present area of the client to the destination. The third capacity is to manage the clients with voice utilizing Information Base through Advanced mobile phone, it gives the data about the destination and it starts to control by saying travel reach, and bearing for every area of the course. Once the 1destination is reached, voice command is given to the VI through smartphone after the search is complete it logs out if VI no more wants to navigate

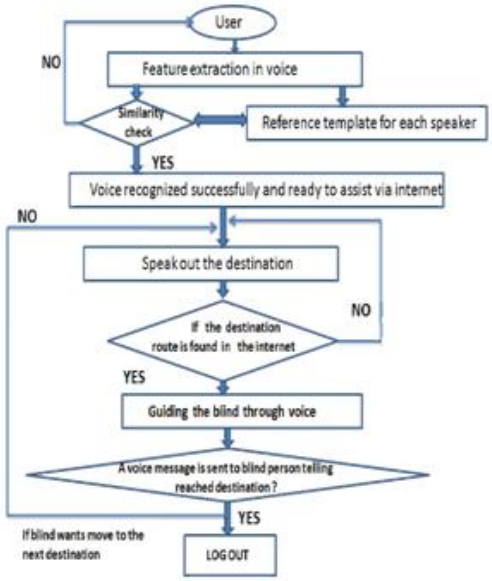

Fig4: Hierarchy of the service

IV. RESULTS

The hardware is tested successfully by placing the RFID tags on the objects and IR sensors for the place detection and obstacle detection in the college campus. Major components and their specification used are listed in Table1.

The program is written in Java and Embedded C language sand is dumped in the database. The Fig 5 shows final output

model to guide VI.

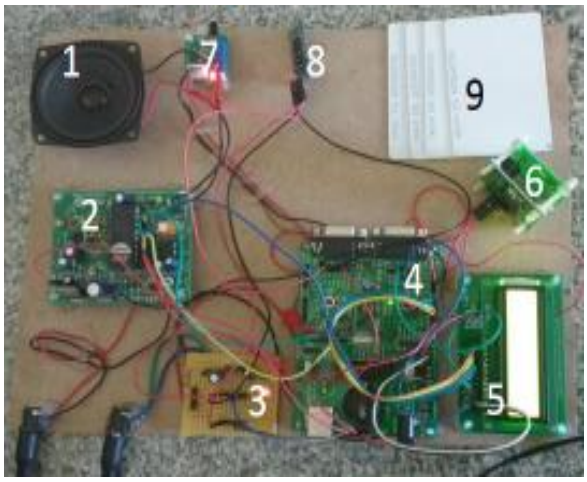

Fig 5:Final Output Model

1. Speaker-Used to speak out the destination stored in the database.
2. Voice Playback Module- Up to 5 different voice samples can record and playback.Nonvolatile Flash Memory Technology without Battery Backup required. Built-in Audio-Recording Microphone Amplifier.
3. Voltage regulator-It is used to divide the power supply into as per the requirement of the hardware components.
4. ARM7 microcontroller-
5. LCD-A 16x2 LCD can display 16 character per line and there are two such line.LCD has 2 register: command and data.
6. RFID reader and RFID tag-
7. IR sensor-IR Based Obstacle Detector.Sensitivity up to - 30cm
8. Bluetooth-Bluetooth is a wireless technology standard for exchanging data over short distances of less than 30cm.

Table 1. Major Hardware Components Used

Sl. No.	Components Name	Specifications
1	ARM7-LPC2148	32-bit RISC Microcontroller, CPU operates at 1.8V, 40Kb of on-chip RAM, 512Kb of flash.
2	IR Sensor	Obstacle detector, Operates at 5V,
3	Bluetooth	Frequency range is from 2.4 to 2.485GHz
4	Voice Play Back Module	Operates at 3 to 6.5V, 340 to 680 sec. Voice Recording Length
5	RFID Reader-RFID tag	Frequency 125kHz, Operates at 3.7 to 4.2V

V. CONCLUSION AND FUTURE WORK

This paper provides aid to blind person and make them travel independently based on Internet of things (IoT) infrastructure, voice recognition method and with additional hardware through Smartphone. This paper focuses only on four destination navigational directions to VI.

In future the additional hardware can further be integrated into the smart phone as a microchip to aid VI to carry portable device later it can be designed for dynamic environment and extended for the wide variety of applications such as smart building where the IoT infrastructurealong with application programming interface detects the VI entering the room and automatically adjusts the air conditioner according to the temperature of the room.

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