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Automated Navigation System for a Specific Locality

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***Abstract*—The world has shrunk as the internet grew large. The best example are maps, navigation etc. People can see their own location from the internet and help to navigate to places, streets, cities etc. But still it has a limitation that maps cannot navigate through an enclosed environment as the environment will be represented as blocks in maps. In such cases when a stranger gets into the environment, to reach a particular point in it, it will be difficult for navigating independently. Also in that situation the stranger has to ask for information from the people in the region which will be leading to a trial and error scenario. So in order to provide the navigating information to the user directly, without using the concept of internet, Automatic Navigation System for a Specific Locality is proposed where the Wi-Fi streamers will be streaming the information to the people in checkpoints to navigate them to the destination points.**

I.INTRODUCTION

A Overview

Navigation can refer to any skill or study that involves the determination of position and direction and further controlling the movement of craft or vehicle from one place to another. It can be used by navigators to perform certain navigation tasks. All these techniques involve locating the navigator's position compared to known locations or patterns. In the Earlier days navigating used to be the most difficult task. People used a compass to identify their destination amongst many other techniques. But now applications like Google maps, waze, bingmaps and whatsoever are being used which minimizes the complexity of identifying the location in an effective manner. They act as a great tool in identifying any location anywhere around the world. When moving into a new place, applications like these are of great use because you need not depend on the locals to get the route. They can accurately provide you the routes to reach the destination.

This paper presents a way to provide navigation to the users by connecting to the Wi-Fi network. Wi-Fi is simply a local area wireless computer networking technology that allows electronic devices to connect to the network. Many devices can use Wi-Fi, These can connect to a network resource such as the Internet via a wireless network access point. Such an access point (or hotspot) has a range of about 20 meters (66 feet) indoors and a greater range outdoors. Hotspot coverage can be as small as a single room with walls that block radio waves, or as large as many square kilometers achieved by using multiple overlapping access points.

Wi-Fi technology may be used to provide Internet access to devices that are within the range of a wireless network. The coverage of one or more interconnected access points (hotspots) can extend from an area as small as a few rooms to as large as many square kilometers. The Wi-Fi hotspots can be made available in different locations for streaming information as shown in figure 1.

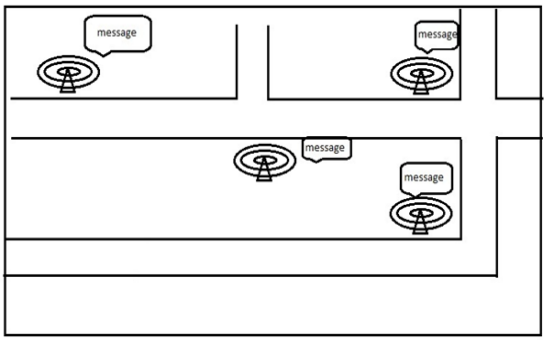

Fig 1- Streamers placed at check points

B. Applications

This idea has its applications in three major categories:

- Location based information applications:

This can be used in areas which are grouped as an enclosed environment like forest areas, reserve zones, institutions where the information about it will not be available in the media such as the internet.

- Traffic efficiency and management applications:

For example, vehicles can able to know about congestion information about a particular route's location to reduce traffic jam near the affected areas.

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- Active road safety applications:

Messages can be sent from a fixed infrastructure to a moving vehicle just as in a scenario when a message is transmitted from a signpost warning the drivers of any immediate inconvenience.

C. Proposed work

The proposed system implements the concept using Wireless Fidelity to provide routing information in the absence of a connection to the Internet. Streamers, which are Arduino based Wi-Fi fields, are set up in relevant areas in the environment which are fed with the data necessary to find the routes to the appropriate destination requested by the user. The User can connect to the wireless network by means of a hotspot and access the data from the Streamer by means of a request and a response message. The streamer at the near vicinity to the user sends a response immediately directing the user to the next nearest Streamer and the consequent information regarding the access point is given. Thus, by a series of route information which is relayed back and forth to the user, any person entering into a mapped environment can easily find a route to the destination even in the absence of the Internet.

II.LITERATURE REVIEW

In the past few months, several different approaches to collaborative sharing of data using different devices have been proposed. This section will explore some of the research approaches

Ms.Rachana N Sawade and Prof.P.V.Dudhe [3] in their paper introduced a methodology to media content sharing by exploiting collaborative amongst Wi-Fi devices via the temporarily-established links over the local server which is based on heterogeneous mobile which is having different mobile platform, users connected to the server like computer System via Wi-Fi. The content sharing is based on sending/receiving data between client server via Wi-Fi connection without the need of taking any service from mobile service provider and without the use of internet connection.

Mr.Patil Ketan C and Prof D.B.Rane [2] illustrated a system that can control home devices from a central control point. They have explained the design and implementation of a low cost but yet flexible and secure internet based home automation system. It uses Rabbit Processor to store the main application source code, web pages and TCP/IP stack which is a vital element of the system software. An Ethernet controller chip, ENC28J60 is used to handle the Ethernet communications and it is interfaced with the Rabbit Processor using SPI protocol. The communication between the devices is wireless. The system was designed to be low cost and flexible with the increasing variety of devices to be controlled. The connectivity to the Rabbit Processor based embedded systems for communication between devices.

Zhuliang Xu and K.Sandeasegaran [1] illustrated a Pedestrian Monitoring System using Wi-Fi technology and RSSI based location by providing a wireless signal detection technique for analyzing the pedestrian traffic movement using Wi-Fi technology and RSSI based localization. The packets are received at a number of stations, distributed throughout the monitoring zone, which can measure the received signal strength. By noting down the location of stations and data collected at the stations, the movement of pedestrian traffic can be analyzed. This information can be used to improve the services, such as better bus schedule time and better pavement design. Based on the positioning result, the mobile tracking system can be used to detect the wireless user movement with medium-precision localization.

Soyoun Hwang and Donghui Yu [7] introduced the design and implementation of a remote monitoring and controlling system using ZigBee networks to target a home network similar to the earlier discussed paper. The remote controlling is implemented using ZigBee networks. The client program in a smart phone is implemented on the android platform. Clients can monitor their homes and send light control commands using the web or a smart phone.

Bhoopesh kumawat, Sudhendra Pal Singh, Chandra Prakash Verma [8] illustrated an intranet based messaging service on android smart phones and tablets which deals with a methodology to provide instant Messaging Service over the intranet which is addressed to android based smart phone and tablet users connected over intranet via Wi-Fi. The instant messaging service is based on sending/receiving messages in intranet through intranet server via Wi-Fi connection without the need of taking any service from mobile service provider and without the use of internet connection.

III. REQUIREMENTS FOR THE PROPOSED NAVIGATION SYSTEM

The system provides navigation for enclosed areas which can't be figured in major applications. When this application is installed in the mobile, it automatically receives the location information from which user can search for his required destination. By this the problem pertaining in the mainframe applications can be reduced. As streamers can even be fixed in interiors of villages or any enclosed areas which can be used to specify the routes to the user. The exchange of information between a requestor and provider by using a fixed infrastructure concept like access points or base stations is a known feature. The application range of such networks may cover location related applications and traffic related applications like the provision of information about a location for new users. Here a Wi-Fi streamer containing the location's information will be acting as a base station and the mobile devices acting as nodes to receive the information. When the device comes across the base station (i.e.) the hotspot region, it can connect to the streamer's Wi-Fi to obtain the navigation information. It's never a complicated process.

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The application itself has a facility to connect to the streamer by which it can receive the information from the same.

Applications like these can help the end user where other apps provide the destinations in just blocks. This system helps to identity places where other applications fail to provide. this can be done by placing the streamers in the locations where navigation is difficult. Apart from this, another advantage of using streamers is to get rid of the sign posts in the streets as all the information that are needed to be conveyed to the people can be stored in the streamers and can be shared. In addition to providing the instructions in steps to reach the destination, this system also presents the information in form of images for easy understanding.

3.1 Wireless Fidelity

Wireless connectivity for computers is now well established and virtually all new laptops contain a Wi-Fi capability. Of the WLAN solutions that are available the IEEE 802.11 standard, often termed Wi-Fi has become the de-facto standard. With operating speeds of systems using the IEEE 802.11 standards of around 54 Mbps being commonplace, Wi-Fi is able to compete well with wired systems. As a result of the flexibility and performance of the system, Wi-Fi "hotpots" are widespread and in common use. These enable people to use their laptop computers as they wait in hotels, airport lounges, cafes, and many other places using a wire-less link rather than needing to use a cable. As a result the Wi-Fi, IEEE 802.11 standard is widely used to provide WLAN solutions both for temporary connections in hotspots in cafes, airports, hotels and similar places as well as within office scenarios.

3.2 Message Transmission

Messages that are transmitted must have an important characteristic that there must not be any delay in the sending of messages especially in cases related to safety issues. A streamer uses routing protocols and other communication protocols of which the 802.11 standard is the most significant. This helps establish a communication link between the various moving objects to enable send and receive data. During transmission, the data suffers from recurrent interruptions due to frequent mobility and sporadically linked network system.

3.3Arduino UNO and Embedded c

Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems. Here this can be used to code the Arduino device and program the streamer. The coding can be done through open software provided by the Arduino website itself. Through this all the necessary data's and instructions can be loaded into the Arduino Uno device which can be seen in Fig 2. The Arduino integrated development environment (IDE) is a cross-platform application written in Java, and derives from the IDE for the Processing programming language and the Wiring projects. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. A program or code written for Arduino is called a sketch.

Fig2- Arduino UNO

3.4 ESP 8266 Microcontroller

The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 that is shown in figure 3 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi ability as a Wi-Fi Shield offers. ESP8266 has powerful on-board processing and storage capabilities that allow it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime.

IV. AUTOMATIC NAVIGATION ARCHITECTURE

4.1. Proposed work

The proposed idea makes use of the concept of hotspot from Wi-Fi to connect the mobile nodes looking for information. These mobile nodes on connection, will receive the information preloaded in the streamer (hotspot provider). This information will be designed according to the location. Streamers, which are Arduino based Wi-Fi fields, are set up in relevant areas in the environment which are fed with the data necessary to find the routes to the appropriate destination requested by the user. A simple architecture of this system is shown in Fig 3.The User can connect to the wireless network by means of a hotspot and access the data from the Streamer by means of a request and a response message. The streamer is also responsible for changing the information according to situations observed.

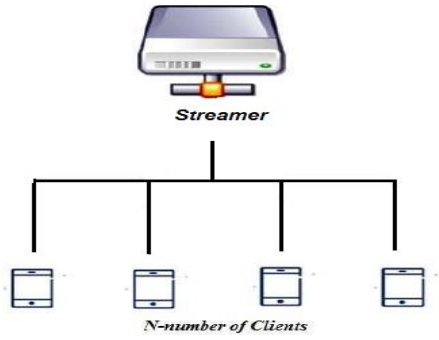

Fig 3- General Architecture diagram

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4.2 Setting up an Wi-Fi streamer

The Wi-Fi streamer module consists of Arduino board with a Wi-Fi transceiver and an Ethernet shield. The streamer module will be placed in particular checkpoints of the enclosed infrastructure. The navigation information to be provided to the users in the enclosed infrastructure is streamed to the users connecting via Wi-Fi. The users who are connected to this particular Wi-Fi network will receive the information and the information will be of html format to load as a webpage in the user's mobile/tablet. This set up requires the integration of the Arduino UNO with the ESP 8266 Wi-Fi module. While the information that is needed to be broadcasted can be stored in the Arduino whereas the ESP micro controller will be useful for transmitting the information. The commands for initializing the module to set up a hotspot can be done in the gnu screen out of the box with the default version of the firmware.

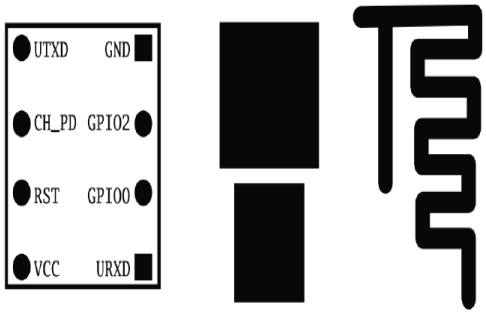

Fig 4-ESP Wi-Fi pinout

The pins mentioned in the Fig 4 are necessary for interfacing with the Arduino. Some ESP modules specifically come out with these pins whereas all modules in default has these pins in their chips. Connection with the Arduino can be done through these pins and it can be programmed to stream the necessary information. The Wi-Fi hotspot can be activated with the set of commands that are needed to be given in the serial monitor. Another important thing to be noted while setting up a streamer is that the power that is given to the streamer should not exceed the limit of 3.3v-5v. Due to this the use of external power supply must be mostly avoided or should be given in the minimal amount. The module can be powered by the Arduino itself from its 3.3v port. This will not affect the Wi-Fi module and can run smoothly for a longer period.

4.3 Receiving information through an application

The mobile interface will be of an android application type which receives the information in form of html from the Wi-Fi streamer. The received html file will be providing the navigation information to the users from a particular checkpoint to other checkpoints or destination. The messages received from the streamer in the form of a file can be done by connecting with the mobile to the Wi-Fi hotspot provided by the streamer. The file can be received through any links or most probably an android application. By this the user can obtain the navigation and other important information through a single click in a smart phone. For this an application which can be installed in mobile is to be created.

This interface can be done by using the Eclipse open source software for java and can be implemented. The Primary use of this application will be to receive the information provided by the streamer. For enabling this Communication to happen, the mobile phone must be connected with the streamer's hotspot. This can be exclusively done within the application itself. Other features of the applications include keeping a track of the routes that have been searched by the user. Apart from these the application also enables the image view of the route in some complex situation where the text information would be hard to reciprocate.

4.4 Intercommunication via router setup

The messages received in the application can be of request and response type. The user can request for the specific location for which the provider can reply with. Each location information can be loaded separately in the streamer and based on the information that is requested, the router can send the messages. The intercommunication can be done by writing up the commands in Arduino software as shown in Fig 6, where the actual coding is done to stream the information. Here the information to the displayed at the start is put up in the setup loop using send command. This will be the default mode during the execution.

In the next function, every operation done is iterated for recurring execution. Every information that are to be streamed is put in separately and the user according to his need can go for the location information by selecting the route information in the application. According to the location or the information requested by the user, the streamer responds with a message.

V. IMPLEMENTATION

In this paper, we describe a short module of the proposed system. We use an Arduino board and a microcontroller ESP 8266 as discussed earlier for streaming the information. It is assumed that a signal is constantly transmitted by the streamer and when the receiver comes into the proximity, the messages get relayed based on the request from the client.

5.1 Circuit for creating a Wi-Fi hotspot

At first a streamer should be set up using a microcontroller ESP 8266 Wi-Fi module and interfacing it with the Arduino UNO. By this an active hotspot region can be activated and through which the messages can be transmitted. This set up is called a streamer for our convenience. The streamer is created as shown in the fig 5. The transception and reception port in the Arduino UNO are connected respectively to the ESP 8266 for establishing connection to send and receive data. The power to the micro controller is provided by the Arduino itself as it is powered by a 3.3v and 5v power supply. Micro controllers use minimal power supply required. So a 3.3v power supply is given to the Wi-Fi module. This allows the module to create a hotspot region. This set up helps to stream the information to application which is pre installed in the device.

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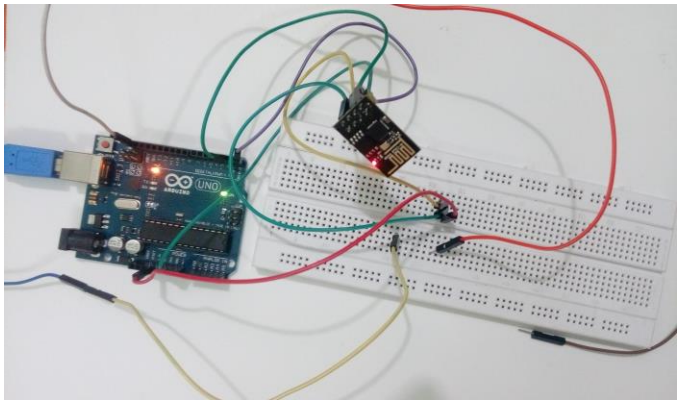

Fig 5-Wi-Fi Streamer set up

5.2 Android application as receiving interface

The information regarding the navigation should be made easily available to the users. For this an android application is developed and by which the information related to the related routes can be transmitted. For this the mobile phone should be within the streamer's range and should connect to that Wi-Fi. The messages received from the streamer in the form of a file can be done by connecting with the mobile to the Wi-Fi hotspot provided by the streamer. The application is created by java program coded in the eclipse open source software. The application is created such that it receives the information from the streamer.

Fig 6- Android application that receives routes from streamer

This application after all the tests will be uploaded in the google playstore from which the users looking for location information can download. A template of the application created is shown in the Fig 6. The facility is provided for user to enquire about the specific navigation information. The UI is simple and provides a point to point instruction to the user

5.3 Communication between mobile application and streamer

The android device will be initiating the request for routes. This minimizes the transmission from the Arduino module and serves the purpose for the requested. The Arduino on receiving the request will know the IP address and port number from the id sent in the request. According to the parameter asked for in the request, the route is loaded in the application. The messages received in the application can be of request and response type. The user can request for the specific location for which the provider can reply with. Each location information can be loaded separately in the streamer and based on the information that is requested, the router can send the messages. The intercommunication can be done by writing up the commands in Arduino software where the actual coding is done to stream the information

Several devices can get the information in a stipulated time. Once the streamer completes the transaction, its route Wi-Fi is to be disabled. For the communication between application and a streamer to happen, the streamer is programmed in such a way that it has a request and response way of transmission. This is achieved by forcing the http request and response model in the system. In the Fig 7, a sample output of the system is displayed. As the location information is stored in the Arduino board, if the user initiates by requesting a route. The streamer first looks up for the information through the commands which is pre installed in the module.

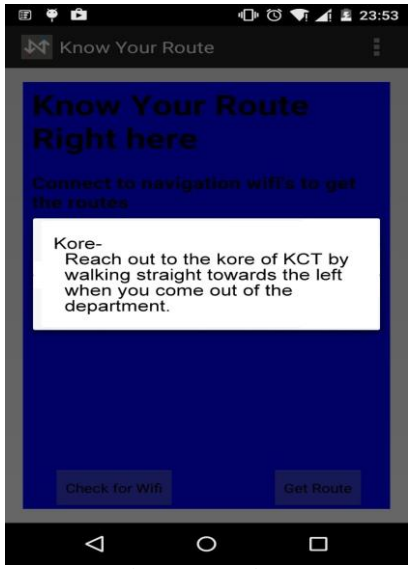

Fig 7- Location information notification in application

Apart from the information provided in strings, this application also helps the user to locate routes through pictorial representation. For this our system provides images where the location information is hard to decode through information. This improves the efficiency of the system and that it is clear to understand. A sample for this image transmission is given in the Fig 8. These images can be automatically loaded when the application is in streamer's checkpoint.

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Fig 8- Route specification through an image

VI.CONCLUSION

The scope and growth of applications providing navigation has grown leaps and bounds. Be it to reduce human errors or to improve efficiency or as a substitute to the existing system. Navigating through streets by using these applications seems to be efficient than enquiring about the routes to the locals. In this paper we described how a streamer can be implemented to provide location information to the end users of this application. In addition to providing location information it can also guide users lost in the forest area and other such environment, where accessing internet is no way possible to find their way to some safer location.

VII. FUTURE WORK

This proposal can also be integrated to work on real time traffic and the users can view the information updated by the Wi-Fi streamers. Apart from providing the routes to reach the destinations to the user, they can be made aware of the present scenario (e.g.: road block) of that route and the user can be warned in advance and thereby providing the next best route. Along with android, the application will be developed for iOS and windows mobile operating systems for wider use.

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