LOCALIZATION APPROACH USING BLE AND GSM

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Abstract- Wireless Localization has been a key field of research ever since the advent of Wireless Sensor Networks (WSNs) in mobile handheld devices for almost a decade. It provides a wide range of applications ranging from day-to-day activities like person/object tracking to remote area localization. In this project, a Bluetooth Low Energy (BLE) and Global Systems for Mobile (GSM) based location sensing system is proposed. The system uses Received Signal Strength Indicator (RSSI) function of Bluetooth 5.0 in case of indoor localization to determine the signal strength between connected node and the BLE device to determine the distance between them by using appropriate mathematical calculations. The outdoor sensing is done by using the Wireless Access Points (WAPs) to locate at nearest accuracy of the required object. This Novel approach brings out the tracking system with ease of users by working in any weather condition and all around the year without any environmental dependencies. The proposed method of remote localizing is expected to outplay the existing contemporary methods by using suitable modern algorithms.

INDEX TERMS- GSM, BLE, WAP, RSS Fingerprinting, KNN algorithm, UWB, Wi-Fi.

I. INTRODUCTION

Internet of Things is a network that can connect many devices and can be used to find, collect data and information exchange. For running the tool, it is easily done using an internet connection. Wireless Localization using newer advancements in IoT systems and services can effectively replace the contemporary methodology of localization. This approach enriches the power optimization and increases throughput. For implementation, Google APIs and Flutter SDKs have been used for improving accuracy of localization.

This paper proposes a method that does not directly make use of GPS system but rather implements localization using Google service called Geolocation API. This API helps in determining the location of the object by accessing nearby Wireless Access Points (WAPs). By using this method, outdoor localization is achieved with accuracy up to 5-10 meters. By using this method, most of the power is conserved as the hardware does not feature a GPS module in its peripheral. In this paper, we discuss about the peripherals used for the implementation of localization. We have also discussed about the conflicts faced in the

existing mechanism and methods to eliminate them by citing to published research papers.

This paper is organized in the following manner. Section II, Section III explains about the system overview and building blocks of the system. Section IV shows the system model which we propose as a replacement to existing methods. Section V shows results and observations of the experiment which is followed by conclusions in Section VI.

II. EASE OF USE

Easy to build with lesser complexities in determining the location of object. It requires absolute zero setup cost as required in other methods such as UWB localization method. This proposed method also provides ease for user to track their property/object with enriched UX based application on their mobile phones. This system also infers meta-data about the location activity based on RSSI value between node and WAP, which helps in improving accuracy. This meta-data can also be monetized if provided to data relying services such as Google Maps, Map my India, etc. Power consumption is also reduced by using suitable algorithms in BLE system. It features Low Power Duty Cycle feature thus allowing device to consume less power while in Idle state. Moreover, the cost estimation of the experiment is much less than most of the contemporary methods as it does not feature GPS system in its periphery.

III. SYSTEM OVERVIEW

The proposed setup consists of two parts hardware and software. Hardware parts include Node MCU esp8266, HC-42 BLE, Sim 800l GSM. Software counterpart include Flutter SDK, Google Geolocation API, iBeacon.

A. HARDWARE SPECIFICATIONS

1. Node MCU esp8266:

In Micro WIFI NodeMCU, a microprocessor which acts as the brain of the overall system of work called the Central Processing Unit (CPU), functions as a system processor and controller for running tasks in the system. The NodeMCU chip contains three basic units

System Specification

The microprocessor consists of the following system parts:

1) Arithmetic Logic Unit (ALU),

2) Control Unit (CU),

3) Register

Arithmetic Logic Unit (ALU) carries out the operations like mathematical and logical computations essential in the system processing. The mathematical computation operations include addition, subtraction, multiplication, and division. The logic operations like AND, OR, NOT, XOR, XNOR, and so on are also carried out by ALU. The Control Unit (CU) takes instructions from memory and executes the instructions, which memory is not periphery of the microprocessor. The Register acts as a place to store temporary data originating from memory before it is being processed by ALU.

A microcontroller is a unit consisting of a microprocessor, memory, timer / counter, and input / output. The CPU becomes a key component of processing information. Memory functions for storing created programs, memory are RAM and ROM. Input / Output links direct to external connections, in I / O there is an analog and digital data system or bus data connection. Time / Counter is the part that works to schedule time.

Fig. 1. NodeMCU.

NodeMCU is an Arduino compatible board used and built for IoT requirements. This micro WIFI NodeMCU uses Wi-Fi SoC, which is ESP8266. This microcontroller that can be configured using Arduino IDE software, using syntax and the specialized NodeMCU library. This micro WIFI device can be connected to the Internet because inside there is already a Wi-Fi module for direct use when there is a Wi-Fi network connection. Fig. 1 shows the micro WIFI used. [7] brought out present disclosure which provides a system for monitoring and controlling farming using drone technology comprising a drone system for monitoring the farm and transmitting information and a ground control system for controlling the drone system and receiving the information. A camera is provided in the drone system for capturing images and video, a GPS module is provided in the drone system for locating image and video captured by the camera, a sensor module is provided in the drone system for measuring parameters of temperature, humidity, gas and pH.

2. HC-42 BLE:

The HC-42 Bluetooth serial communication module is a new generation of data transmission module based on Bluetooth Specification V5.0 BLE Bluetooth protocol. Its operating frequency is 2.4GHz ISM, with GFSK modulation. Such a module has a maximum transmission capacity of 4dBm and reception

sensitivity of -96dBm. The module is 26.9mm × 13mm × 2.0m and includes a stamp hole packing process. It can be embedded in the program in a simple way. Fig.2 shows HC-42 module used.

Fig 2. HC-42 BLE module

3. Sim 800l GSM:

From Fig 3, X

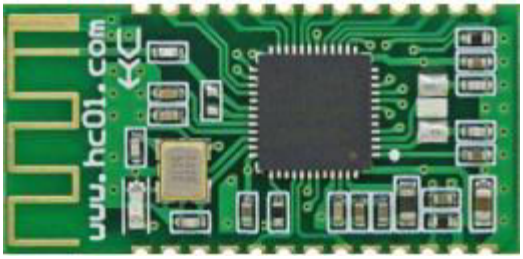


Fig 3. SIM 800l GSM module

A. Software Specifications:

Configuring.

i. Google Geolocation API:

The Application Program interface (API) is also a protocol a website development tool. API is a rule of thumb how software components should be integrated. REST (Representational State Transfer) is the most widely used API and web-based connectivity that uses HTTP as data connection protocol.

Google Maps is a worldwide mapping service that can be accessed for free as provided by Google. This service offers a few street-level indicators maps, satellites, traffic conditions, and route searches driving route or not. Google itself actually provides services

through the Google Maps API can be used for installation on websites of third parties that can be used to benefit the website itself. Google Maps API is a visual interface for an app that can be accessed using JavaScript, Python, HTML, etc. On Google Maps API There are 4 types of map model options provided Google, including:

1) ROADMAP, to display 2 dimensional maps

2) SATELLITE, to show satellite images

3) TERRAIN, to symbolize physical freedom at the top and show how high the area is

4) HYBRID, will display satellite images in addition and show content from ROADMAP (street and city name)

ii. Flutter SDK:

Flutter is an open-source SDK for creating the most efficient, most reliable mobile apps for iOS and Android. A few of the key features of flutter are - Timely integration is a way of running computer code involves compilation during execution of a program at run time rather than prior to execution.

With Flutter, we believe we could provide solution that offers you the best of both: faster graphics and UI, powered by native ARM code, which directs both popular mobile applications.

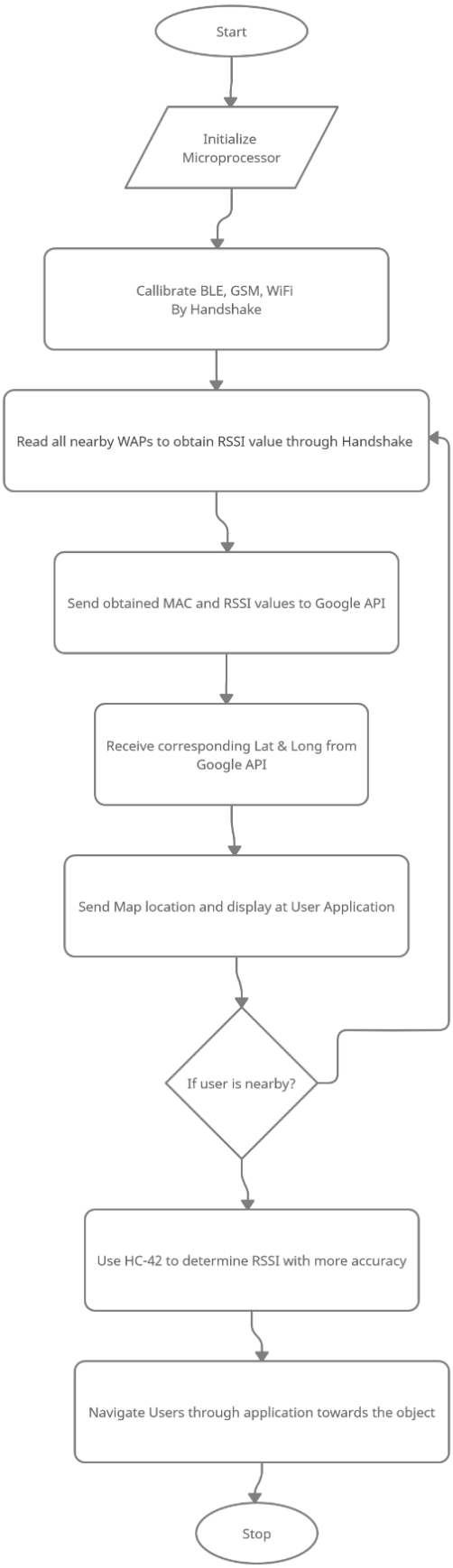
WORKING METHODOLOGY

A. Setting up the system:

The Project is executed using ESP8266 board to get live co-ordinates of our location**.** This becomes possible because of Google's Geolocation API**.** Android OS for smartphones is powered by Google. Generally, most of the phones have GPS and Wi-Fi enabled all the time so Google not only tracks our location but it also tracks the nearby Wi-Fi networks. For example, if you are walking through a street with Wi-Fi and GPS enabled so your phone is constantly scanning the nearby Wi-Fi networks and what Google does, it saves the MAC addresses and the name of this Wi-Fi networks along with the location of our phone. So based on the signal strengths received by phone, Google estimates the location of that particular Wi-Fi network and it saves that data into the database. Therefore, next time if anybody will pass through that same Wi-Fi networks and does not have GPS enabled in his phone he can still get the location of the phone based on the location of that particular Wi-Fi network. More the number of Wi-Fi networks nearby more precise will be the location. Google Developers Webpage provides us with a specific API key to use for Google Geolocation access. The next step is to program the Node MCU for getting GPS data. The necessary libraries and board files are used for execution of the code. The code which is executed along with the API key will yield a set of latitude and longitude coordinates relating to the location of the device. The application can easily locate and display the device using the coordinates and Google Maps access. The proposed approach focuses on minimizing the power consumption by using Wi-Fi Access Points instead of GPS Technology. Indoor localisation (Short range tracking) is done by using BLE (Bluetooth) Technology for tracking the accurate location of the device. [1] emphasized that people who are visually impaired have a hard time navigating their surroundings, recognizing objects, and avoiding hazards on their own since they do not know what is going on in their immediate surroundings. We have devised a new method of delivering assistance to people who are blind in their quest to improve their vision. An affordable,

compact, and easy-to-use Raspberry Pi 3 Model B+ was chosen to demonstrate how the proposed prototype works. [4] emphasized that Security is an important issue in current and next-generation networks. Blockchain will be an appropriate technology for securely sharing information in next-generation networks. Digital images are the prime medium attacked by cyber attackers. In this paper, a blockchain based security framework is proposed for sharing digital images in a multi user environment.

B. Algorithm:



IV. RESULTS AND OBSERVATIONS

The project has an improved accuracy over the traditional methods over localization in a wireless manner. The wireless connection resulted in seamless stream of required location data to user application with lossless accuracy over the network. GSM benefits over mobile network connection for reliable delivery of data to the user. Overall, comparison between existing mechanisms and other alternatives have made our experiment to conclude by using BLE, Wi-Fi Access Point based Localization. This approach balances between both power conservation enduring longer operational hours and improved accuracy of localization.

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