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GPS Based Location Tracker: A Review

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Abstract: An Android is a software platform with Open Source tool and a location tracker helps you to trace the route of near once. There are lots of problem faced by an average person. They want to trace the daily activity of their closed once. Due to the hardware and software characteristics of the smartphone, these devices are suitable to work as terminals for such a system. This paper describes the working of GPS system using android app and the goal of this paper is to present the design and implementation of a tracking and localization system based on android phones, able to find persons in case of accident and give a set of necessary information for rescue. The System sends the GPS coordinates to database periodically, display the coordinate on a map and computes the shortest route to the accident site.

Keywords: GPS, Trilateration, Atomic clock, NAVSTAR, NAVIC.

I. INTRODUCTION

GPS is an acronym for Global Positioning System. GPS uses satellites to fine the position. The first gen GPS (Navstar GPS) was commissioned by US military and was used by US's Air Force in 1973 to provide pin point location of their aircrafts, ships and military personnel anywhere on the planet. It was also designed to intentionally figuring out all the calculation required to launch any missile from a mobile platform [13]. In the beginning of its era GPS system was not open to public and were only used for military purposes. The first time this service was opened to public was in year 2000 by the launch of GPS 2 [6] satellite. GPS is not actually free, it cost approximately 2 million USD each day for its maintenance and operation. GPS works on the principle of trilateration. The GPS network consist of 24 satellites orbiting [1] [2] [4] around the globe such that 4 satellites always have a line of site to the receiver at any time of the day. Each satellite contains an atomic clock [7] [11] which is by far the most accurate clock available. It is a navigational system used to find location of receiver around the world using satellite to pin point the location. There are different types of navigational system around the globe such as NAVSTAR(USA), GLONASS(Russia), Galileo (Europe), Beidu 2(China), NAVIC(India).

II. WORKING OF GPS

GPS network consist of 24 satellites orbiting around the globe at an altitude of 20,000km such that there are always 4 satellite above our head at all time. This is quite important as on the basis that GPS point positioning require at least four satellite to calculate three position co-ordinate and the clock deviation. HTTPs satellite broadcast [3] [8] navigational message towards earth which contains extremely accurate timestamp [10] which is obtained through an atomic clock [7] [11] on board the satellite and the satellite also broadcast their position at the time of broadcast. All GPS system broadcasting [3] [8] at 1.57542 GHz and 1.22 GHz. With each satellite sending exceptionally accurate time stamp to earth our phone or GPS can compare the difference the time between when the signal was sent to when it was received to account the distance between the user and the satellites. By multiplying this time difference with the speed of light [13] [14] as the signal is sent at the speed of light [13] [14] , we get the distance between the user and the satellite. As the satellite is also sending where about they are, we start to draw the sphere around the satellites where we being somewhere at the outer orbit of that circle. As we introduce more satellite into account, we begin to get closer to where we are. By calculating the time differences between the satellite, we start to pin point where we are to 5 to 10 m accurate.

III. WORKING OF TRILATERATION

Trilateration is a process of finding the location of any point where all we have is multiple distances measurements. Let's assume we have three objects a, b and c, we all know the position of these three object . All three object are x, y and z meter away from an object d. Now we have to find the exact location of object "d". If we create a circle around "a" whose radius is equal to the distance between a to d we can assume that the object reside anywhere in the circumference of that circle, but

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we don't know exactly where. Now let's take consider of "b" and now draw a circle around it with the radius equal to distance between "b" and "d". From fig 1.2 we can see that now we have two intersection between these two circle. It provides us with two point where object "d" can be. Now let's do same with object c and as you can see from fig below now the interception point where circle a, b and c meet. It is the point where that object "d" will be. This is how trilateration works.

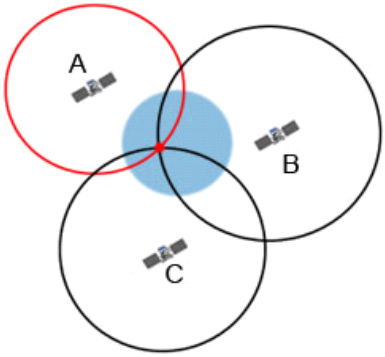

Fig. 1 Trilateration structure

IV. LITERATURE WORK

Fang, B.T describes that while calculating the distance between the user and the satellite there are few factors that can create potential error. The most significant is due to the ionosphere, a part of the upper atmosphere spanning from 60 km to 2000 km. Free electron occur in ionosphere plenty enough to have an appreciable influence on electromagnetic wave passing through this layer. This error is substantially smaller when the satellites are directly overhead.
Small variation in atomic clock found onboard these satellites can cause major error. A clock error of 1 nanosecond can translate to 30 cm miscalculation.

To prevent this problem Oszczak, B. Proposed the theory of relativity [11] [12] is used. Which atomic clock clocking at ever slightly slower than the clocks which are on the ground, it translates to 7 microseconds delay each day. General relativity is also used. With the effect of gravitation, the frequency shift far greater than the 7 microsecond/day delay due to the velocity, relative to the earth. As the theory state "the clock which is closer to a massive object will be slower than that the clock which is further away". Therefore, atomic clock on GPS are faster by about 45.9 microseconds per day. Combining the 7-microsecond delay with 45.9 microsecond, this adds up to 38.6 microsecond delay.

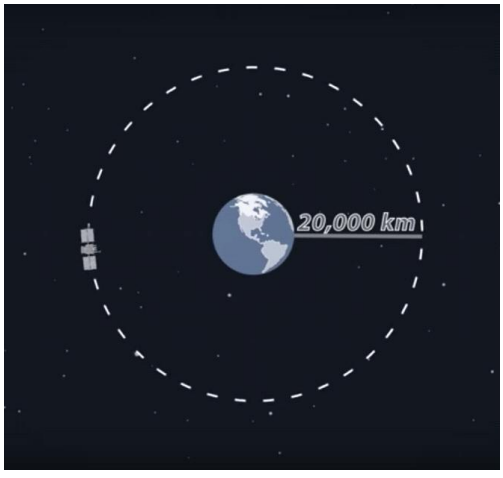

Fig 2: Location tracking system

J.S. Abel describes one more factor is a 10 km a day pseudo range error. This is compensated by lowering the clock frequency slightly down from 10.3 MHz to 10.22999999543 Mhz.

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V. CONCLUSION

This paper put light on how GPS tracking works and how it is beneficial for human advancement. Aviation company uses GPS for navigation and collision avoidance, commercial ships won't be able to find way home. Scientist uses GPS to find detail about earthquake. Surveyor use it to determine property line. Businesses use it to track delivery vehicles. Dreaming about driverless car is possible due to GPS. My work expands the use of GPS for public safety as, kids can be connected with their family and can be tracked down in emergency with turn by turn navigation [6]. Through and out, GPS have changed the way see distance and location and safety of people, things and belonging, it has provided with guidance and a way to communicate to the world. To further develop this idea, we can take help of IOT to make everything reachable with turn by turn navigation [6].

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