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Tracking System using LoRa Technology

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ABSTRACT: It is difficult to track the children, aged persons, dementia patients, animals, pets. During grazing, some animals would go missing. It is a tedious process to find the missing persons or animal manually. Persons or Animals can be tracked individually with the use of available technologies like RFID, Wireless sensor networks, Low Power Wide Area Network (LPWAN). RFID technology gives a very good battery usage which long last for upto 15 years but gives the location of the RFID reader and not the RFID tag. Hence, the real time tracking is lost. In Wireless sensor network, it sends the information through sensor node but the power consumption is very high and every node has to have a GSM module and must be recharged along with battery. LoRa is a wireless technology developed for low power wide area networks. This technology is an exciting development of low power, long range wireless transmissions. The proposed project uses the LoRa technology to create low-weight and low-cost tracking devices that can be safely deployed on persons and animals. The main aim of this project is to present the solution implemented to track the persons and animals. LoRa end node transmits the GPS data to the user through wireless link. User can track the persons and animal and can monitor its surrounding location using android application.

KEYWORDS: LoRa, Low Power Wide Area Network, RFID, GPS.

I. LITERATURE SERVEY

Monitoring of animal or pet has always been a subject of great interest. Monitoring of animals by farmers is a difficult task due to the difficulties of tracking and classifying their actions. Nowadays, technology allows designing low cost systems that make these tasks easier to carry out, and some of these systems produce good results; however, none of them obtains a high-accuracy classification because of the lack of information. Monitoring the animal or pet is a hard technological task to implement.

II. METHODOLOGY

Objective of this project is to present the solution implemented to track the Persons, animals and pets using LoRa technology in the wide land. LORA module tied to the collar of animal transmits the information to the user or Receiver. Data received is displayed on the monitor.

Various works have been carried out on the animal tracking system. Due to rapid advancement in technologies, animal tracking system can be achieved using one of these different technologies.

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2.1.Block Diagram

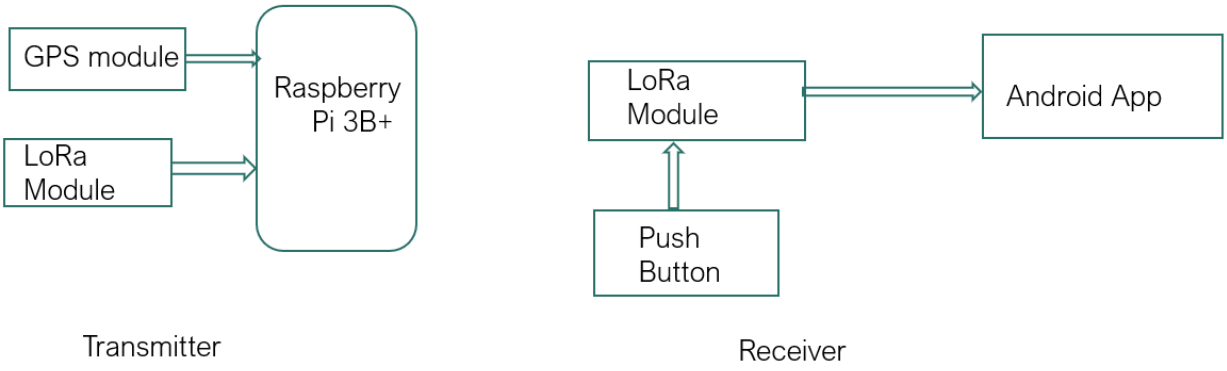

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Fig.1.Block diagram of proposed system

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2.1 LoRa Technology:

Long Range Technology Long Range (LoRa) Technology is wireless communication system, promoted by the LoRa Alliance. The protocol refers to three distinct layers: Implementation of LoRa modulation is done in physical layer LoRa WAN technology is implemented in Medium access control (MAC) layer, the Application layer, which is a bridge. Long Range Network which offers noticeable features such as wide coverage areas, low power consumption, bandwidth optimisation and re configurability.

LoRa stands for Long Range Radio. It is a new wireless protocol designed specifically for long-range (868MHz up to 2km), low-power communications. Each LORA gateway has the ability to handle up to millions of nodes. The signals can span a significant distance, which means that there is less infra structure required, making constructing and network much cheaper and faster to implement.

A LORA Node usually operates on a Battery and consists of a Radio Module and Microprocessor. The Microprocessor is used to read the data from the senor and send it in the air through the Radio module which will then be picked up by a LORA Gateway. The LORA Gateway also has a Radio Module and a Microprocessor but is normally operated over AC mains since they require more power. A single LORA Gateway could listen to multiple LORA nodes, while a single LORA node could also send information to multiple gateways, this way the information from the node will be picked up gateway without it being lost. When information id is sent from the node to the gateway, it is called as Uplink and when it is sent from gateway to node, it is called as Downlink.

LoRa uses a proprietary spread spectrum modulation that is similar to and a derivative of Chirp spread spectrum (CSS) modulation. The spread spectrum LoRa modulation is performed by representing each bit of payload information by multiple chirps of information. The rate at which the spread information is sent is referred to as the symbol rate, the ratio between the nominal symbol rate and chirp rate is the spreading factor (SF) and represents the number of symbols sent per bit of information. LoRa can trade off data rate for sensitivity with a fixed channel bandwidth by selecting the amount of spread used (a selectable radio parameter from 7 to 12). Lower SF means more chirps are sent per second; hence, you can encode more data per second. Higher SF implies fewer chirps per second; hence, there are fewer data to encode per second. Compared to lower SF, sending the same amount of data with higher SF needs more transmission time, known as airtime. More airtime means that the modem is up and running longer and consuming more energy. The benefit of high SF is that more extended airtime gives the receiver more opportunities to sample the signal power which results in better sensitivity as shown in fig as.2

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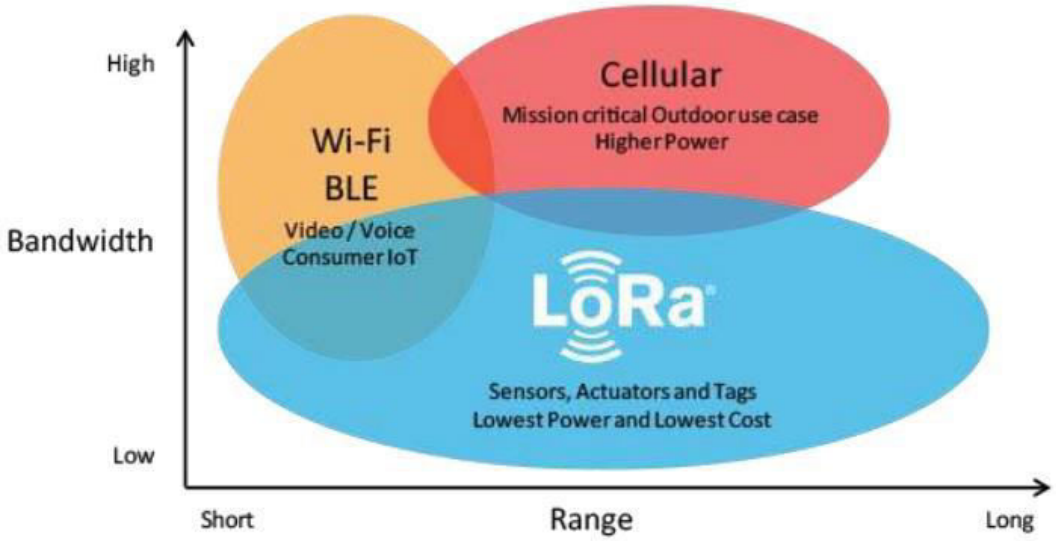

Fig.2 Block diagram of LoRa

2.2.WHY LORA:

LoRa Technology has revolutionized IoT by enabling data communication over a long range while using very little power. When connected to a non-cellular LoRaWAN network, LoRa devices accommodate a vast range of IoT applications by transmitting packets with important information. LoRaWAN fills the technology gap of Cellular and Wi-Fi/BLE based networks that require either high bandwidth or high power, or have a limited range or inability to penetrate deep indoor environments. In effect, LoRa Technology is flexible for rural or indoor use cases in smart cities, smart homes and buildings, smart agriculture, smart metering, and smart supply chain and logistics. Actually Wi-Fi has more bandwidth and range is limited but the cellular has more bandwidth, range and consumes more power. But LoRa has high range and consumes less power.

2.3.RASPBERRY PI:

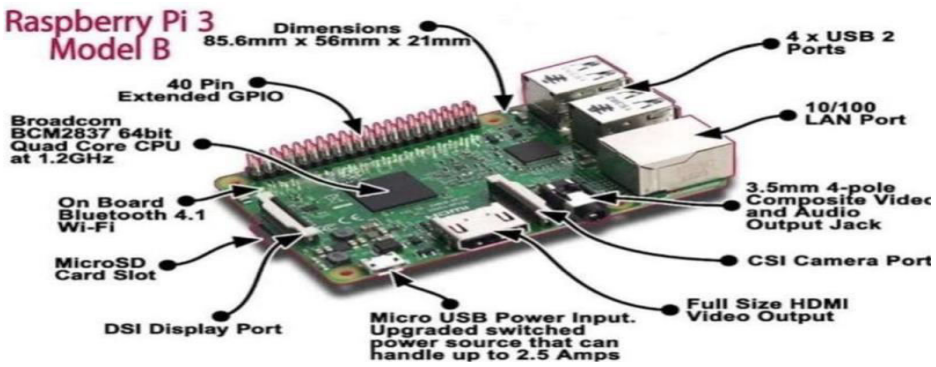

Fig.3..Raspberry Pi

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These boards use an Atmel ATmega644 microcontroller clocked at 22.1MHz, and a 512K SRAM for data and frame buffer storage. By 2008, processors designed for mobile devices were becoming more affordable, and powerful enough to provide excellent multimedia, a feature which would make the board desirable to kids who wouldn't initially be interested in a purely programming- oriented device. The project started to look very realisable and feasible. Eben (now a chip architect at Broadcom), Rob, Jack and Alan, teamed up with Pete Lomas, MD of hardware design and manufacture company Norcott Technologies, and David Braben, co-author of the BBC Micro game Elite, to form the Raspberry Pi Foundation to make it a reality. Three years later, the Raspberry Pi Model B entered mass production through licensed manufacture deals with Element 14/Premier Farnell and RS Electronics, and within two years it had sold over two million units.

The Raspberry Pi has a Broadcom BCM2835 System on Chip module. It has a ARM1176JZF-S processor. The Broadcom SOC used in the Raspberry Pi is equivalent to a chip used in an old Smartphone (Android or iPhone). While operating at 700 MHz by default, the Raspberry Pi provides a real-world performance roughly equivalent to the 0.041 GFLOPS. On the CPU level the performance is similar to a 300 MHz Pentium II of 1997-1999, but the GPU, however, provides 1Gpixel/s, 1.5Gtexel/s or 24 GFLOPS of general-purpose compute and the graphics capabilities of the Raspberry Pi are roughly equivalent to the level of performance of the Xbox of 2001. The Raspberry Pi chip operating at 700 MHz by default, will not become hot enough to need a heatsink or special cooling.

2.4. LoRa Module:

SX1278 LoRa RF Module is one of the latest RF technology and long-range module. SX1278 uses the SPI communication protocol that is suitable for those devices and controllers which has only SPI communication. The module uses an antenna for proper RF communication. It uses multiple types of modulations for data communication which is selectable. SX1278 uses simple RF communication like other modules but its multiple modulation methods and range up to 5KM-10KM makes it best for long-range communication. It uses the Lora spectrum communication technique which extends its range to a maximum of 10KM.

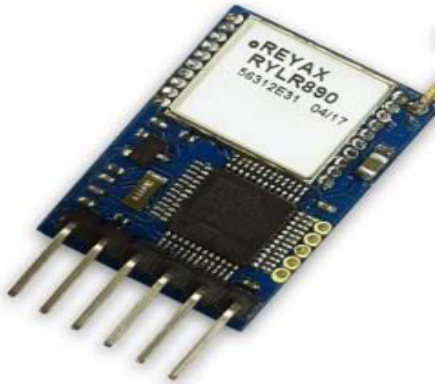

Fig.4.LoRa Module

2.5 G.P.S Module:

Global Positioning System (GPS) is a satellite-based navigation system. NEO-6M GPS module as it is compatible with a variety of GPS receivers. It has a built-in ceramic antenna. Integrates with a 3V button battery. Normally GPS works in any weather conditions at anywhere in the world. A GPS receiver must be locked on to signal of at least 3 satellites to estimate 2D position (Latitude and longitude). The GPS idea depends on schedule and the known position of GPS satellites. Every gp satellite ceaselessly transmits a radio flag containing the present time and information about its position.

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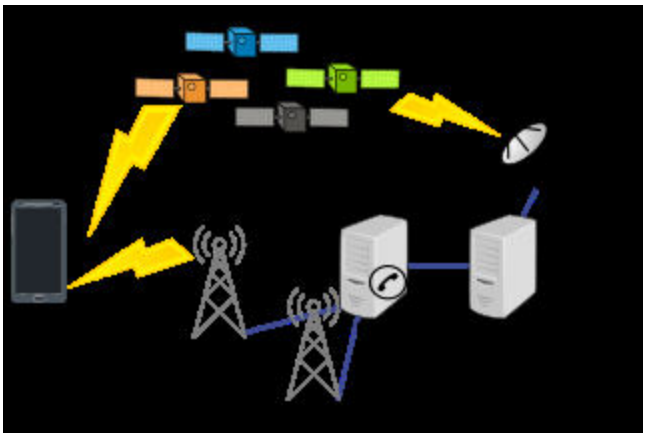
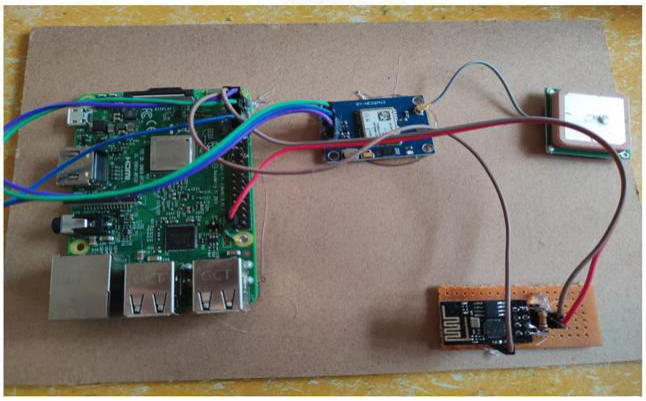


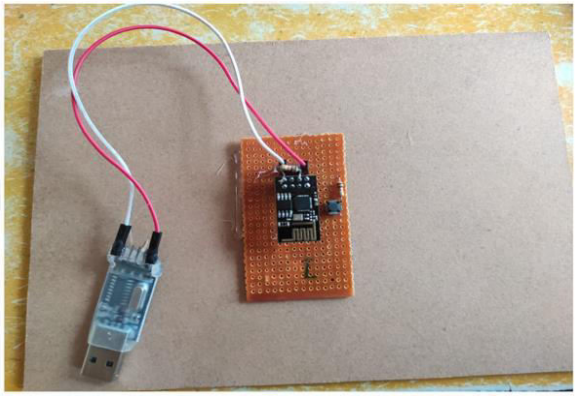
Fig .5: Working of GPS

III. EXPERIMENTAL RESULTS

This project presents the smart way of tracking The result shows the higher accuracy is achieved using this project. This made the project more user friendly and reliable. The proposed method is verified to be highly beneficial to the parents and dementia patients. Gps determines the precise location (longitude and latitude) of a vehicle or person or other asset to which it is attached on to record the position of asset at regular intervals. The recorded location data can be stored within the Android App.



(a)



(b)

Fig.6.(a) Transmitter (b) Receiver

After giving the supply to the kit module when any doubt occurs or any abnormal situation then the user press push button then the location can be seen in Thing view mobile app. The GPS module tracks the longitude and latitude and given to the Raspberry Pi and it is given LoRa module at the transmitter side and at the receiver side LoRa receives the data. After pressing the push button longitude and latitude values are displayed and shown in Fig .7.(b)

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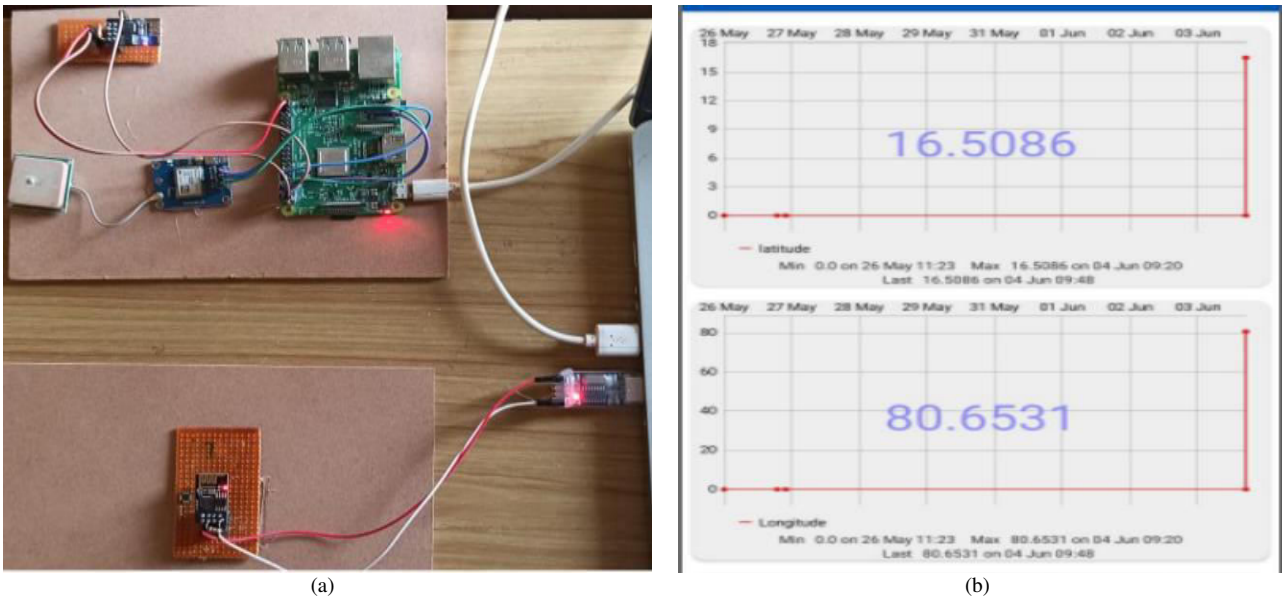

(a) (b)

Fig..7.(a) After pressing Push Button (b) longitude and latitude values

IV.CONCLUSION AND FUTURE SCOPE

An energy efficient collar or wristband or chain is designed by integrating the latest LoRa communication and GPS tracker, where it is able to support up to so many hours with frequent location update with low power consumption in order to take care and track the location of a person or animal or patient onto real-time google maps. This can be implemented with LoRa WAN to create a smart city as the range can be extended to larger radius. LoRa WAN supports upto 5Km communication in urban areas and 20Km in rural areas.

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