A PROJECT REPORT
on

DISTANCE MONITERING AND DATA TRANSFER THROUGH RADIO FREQUENCY COMMUNCATION AND GPS MODULE

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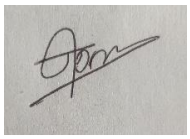

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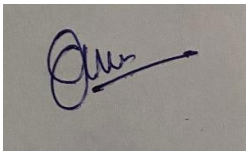

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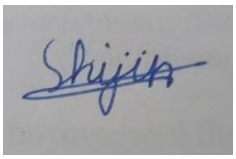

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ABSTRACT

In today's world with increasing price of fuel and traffic people are searching for an alternative mode of transport which is cost effective, fast, ease of access, time management and frequency in term of availability. Above parameter are fulfilled by metro's and bus service. Since not every state are having adequate metro connectivity making bus service only reliable service. Issue with bus service is that it is not time punctual due to various reasons among which traffic, under constructed road plays a pivotal role hence making it difficult for passenger to decide whether to wait or opt for any other mode of transport. Here in our project we are making bus service little more reliant by telling passenger standing in bus stop, bus detail like bus number , distance and howmuch time it takes to reach bus stop by using LCD panel . In our project we will be using Arduino, GPS module, Nrf24l01 and LCD panel. Latitude and Longitude of bus stop will be fixed in Arduino which will calculate distance of bus by using input it receives from transmitter side. Transmitter side has GPS module which will send Latitude and longitude to Arduino in receiver side which will send same information to receiver side using nrf24l01 transmitter.

ABBREVIATIONS

GPS Global Positioning system

I2C inter-integrated circuits

LCD liquid-crystal display

GSP liquid-crystal display

LNA Low Noise Amplifier

$\mathbf{F_c}$ Centripetal Force

$\mathbf{F_g}$ Gravitational Force

LIST OF SYMBOLS

,fq(t)g	Displacement vector
fq(t)g	Velocity vector
fq•(t)g	Acceleration vector
m	Distance in metre
GHz	RF band used
dBm	Navigation Sensitivity
mA	Operating Current
V	Operating Voltage
ohm	TxD/RxD impedence
Hz	Navigation update rate

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CHAPTER 1

INTRODUCTION

Most convenient and easy mode of transport is always public transport which include metro's and bus. Due to unavailability of metros in every state and less connectivity in some other state make bus service only public transport to opt for issue with bus service is that it is not time punctual due to various reasons among which traffic, under constructed road plays a pivotal role hence making it difficult for passenger to decide whether to wait or opt for any other mode of transport hence to tackle these issue we are making project making bus service little more reliant by telling passenger standing in bus stop, bus detail like bus number and distance by using LCD panel.

This idea has arrived from metro stations where lot of sensors are inbuilt which is costlier and immobile thus not suitable for roadways as circumstances like road blockage due to water logging, under construction road, protest may occur at any time due to which a bus will have

to change its route and moreover its not economically viable to set up sensors in each and every route of a state.

The Railway uses very sophisticated techniques so as to monitor the distance such as track contorl in which the number of axial are tracked before and after the clock using IR sensors, it also uses some track diverting techniques in which the tracks are diverted for one point to another as per the route chosen. These thing can be done in railway because they move in a fixed track and the track length are fixed but this is not the case with our project, in compare to the railways the road transport are highly unpredictable and hence these technique cannot be used.

A vehicle facility, particularly within the foundation, which has been well recognized in India. Maximum of the colleges and housing faculties have subcontracted their transport facility to the general community automobile corporations, and the mainstream of them have a correct schedule. collectively of the foremost reasonable suggests that of conveyance to travel to field, the vehicle serves a massive popular of scholars for most academic establishments.
When itinerant in automobiles, travellers typically wish to understand their correct entrance time, however the bus schedule is missing dependability in terms of timing. Hence, the automobile entrance scheme could be a facility that goals to produce a lot of suitable transport provision, particularly for the groups within the organization, the bulk of that are extremely addicted to automobiles for conveyance. The entrance scheme can accommodate 3 major elements.

• Maintained by subtle GPS knowledge, the classification are ready to offer period sites of the affecting automobiles.

• As well counting on the GPS information, automobile operators will have an outline on the automobile's newest "barriers," which
mention to points on the public-facility corporation way.

• the newest "barriers" offer dependable info for the users to prediction imminent automobiles.

This scheme aims to grow a paradigm group for automobile watching that's ready to accept GPS knowledge, detect the real-time sites of automobiles, and approximation their arrival times. For circumstance education functions, the paradigm scheme is modified to the applying

in Sri Ramaswamy Memorial Institute of Science and Technology (SRM), chiefly for college kids living in Utter Pradesh

This scheme has only if period transportation info for the automobile fast transportation (BRT) scheme supported GPS complex instinctive automobile position (AVL) knowledge . Compared with the old-style notice system, the promoted system traces buses' correct locations of entrance and leaving at breaks through the current BRT stage ability, that is termed the stage canopy entrances (PSDs) system. solitary if the bus station at a yard among a allowable mistake differ will the motive force exposed or shut PSDs exploitation aboard spreaders to channel indications, which may be conventional by stage receivers riding on the stage's edge. exploitation the present capitals, the promoted system syndicates GPS and signs—called PSDs system during this article—to offer period information concerning transit services to the traveler's BRT scheme. The travelers are happy by period transportation info, notably with correct info of automobiles' entrances at and leavings after their halts. this technique is not appropriate within the field scenery as a result of it uses associate degree infrared system, kind of like associate degree RF system, which may discover objects briefly vary, permitting the likelihood of the illegal interpretation of IDs and debit cards. Tags are request exact. RFID labels are typically greater than barcode tags and might form up for the disadvantages of deteriorating to publicise bus locations due to lost knowledge after GPS.

Following, in 2013, L. S. study, "Persons chase Scheme exploitation world Aligning Scheme and world Scheme for Moveable Message," projected a real time, small scale, high-fedality automobile position-tracking scheme. By by means of smartphones as chase device, the projected method involved the power to trace automobiles mechanically in actual period through customised application while not needful exterior power among eight-hour in operation aeras. In adding, a made-to-order map alteration was projected to hide the parts wherever the sites weren't out there through customary map services like Google Maps . The system needed LTE/4G knowledge for message. By the tip of 2020, H. Sujatha and G. J. Sruthi finished the look associate degreed growth of an humanoid mobiletracking scheme . In 2014, A. Sankaranarayanan and F. Hamilton shaped a scheme referred to as the "Mobile-Empowered Automobile Following" system . The scheme used RFID to seek out the efficient sites of transportation . The scheme additionally used folder SQL for keep knowledge and conveyed maps to the users on mobile . this technique cast-off devices like GSM networks, SMS, and RFID . The scheme's knowledge used GMS for chase plans at that time sent the info to the central management unit (CUU). The CUU could then direct the data to rd headsets at

automobile halts and operators' plans. the data can be saved finished SMS. Through humanoid requests and junction rectifier

illumination at automobile halts, the automobiles' efficient sites can viewed from Yahoo Maps. The GPS organizes of automobiles were sent to the CCU attendant for scientific discipline to induce the automobiles' calculable arrival time. This project scheme is beneficial for people as a result of it will save them longer to achieve their location. during this scheme,

yahoo Maps is a lot of advanced than Google Earth as a result of it wants the applying programming interface (API) key . The scheme used internet knowledge is stored in application server and seem as Yahoo maps to users on human schemes. The way of doing is a lot of difficult as a result of the data should processed on the server, which will take time to challenge for the user. In 2020, K. Uolaskar et nl. developes a paper which represented the look and application of a period and disconnected

GSM huntsman exploitation associate degree Arduino. Previously, period and disconnected GPS huntsman schemes were enforced distinctly.

There were buses on the market to the passengers motion to varity of places, however neighter many passenger consume whole info regarding these special automobiles. Completely, data specifically their number of buses that head to the specified destination, bus statistics, bus timings, the routes through that the automobile well pass, duration taken for the vehicle to achieve its journey's end locationwould contribution the travelers with numerous routes, locate the present site of the bus and provides the right duration taken by bus to reach the destination.

CHAPTER 2

LITERATURE SURVEY

2.1 RAINWAYS LOCATION SCHEME FOUNDED ON GSM & GPS

Prof. Noornima Vahesp, Rahesh Dmbekar2, Datya Rrakash Psndey3, Katan Gandadhare4, Saacdin Hstawte5 showed the it was possible to calculate the tracking can be done using GPS and GSM . his newspaper contracts around 1 of the well-organized approaches to evade sleeper crash and hindrance discovery. A GSM system is existence used highest in pion the site of responsibilities on railway tracks. This paper was able to develop an brainy railway locating system and obstacle detection system. With this information the train controller was able to make accurate decision.

2.2 SMART BUS TRACKING SYSTEM USING NRF TECHNOLOGY

Rakshitha BK, Fasila Banu, Sneha Ashok Naik, MR. Prakhyath were able to make smart bus tracking system. There project was able to achieve these kind of result with the help of nRF and Wifi system. They created an app on android and with the help of servers to store the information which was gathered. The information was update in the server each time when the task was completed. With it is linked to the cloud and going through the andriod app. The not ustlizing time of the user can be less. Not complex mode of message is the key feature of the Bus Tracking system.

2.3 REAL TIME WEB BASED BUS TRACKING SYSTEM

Done by MkniniKumbhar, MeghhnaSurvase, Prdtibha MAvdhutSalunk applied "Actual Period Mesh Founded Automobile System Tracking" The reason scheme remote user for bus can have less waiting time. At any point of time the users can track the time. Infromation stured in the server is retrieved toward by the remote user using web based appication. The system we use is a web based system but people are using andriod app todays world is most likely to use smart phonethe web based appications are not covinent for the users hence the andriod appication is the only was to go

2.4 A SMART BUS TRACKING SYSTEM USING LOCATION-AWARE SERVICE AND QR CODE.

Authors Sülayman Ekan, ahaet Saaarh have implemented the system "A keen Automobile Following Scheme based on QR code and location- aware service." In this research paper, bus locating system ay smart phone user can track the bas with its camara and qr scanner at the bus stop to know projected bus arrival times, current location of the bus. The disadvantage in this scheme was that user has to physically present at the bus stop for scanning the QR code

2.5 RFID BUS TIGCKETING SYSTEM

Author “Yussuf Abdulslahi Badamsasi” have realized the scheme “RFID bus ticketing system” RFID card discard manual and mechanical way of having ticket

2.6 IMPLEMENTATION OF SECURE COMMUNICATION VIA THE RF MODULE FOR DATA ACQUISITION

This article done by Gabriel Gaspar and Pavol Tanuska describes the use of the VirtualWire communication protocol using radio frequency waves with a carrier frequency of 433MHz-900MHz. The main topic of the article is the design and implementation of a secure one-way communication channel. Such a solution consists of a transmitting device with implemented desired sensors and a receiving device that aggregates data from multiple transmitters.

2.7 LOW-COST IMPLEMENTATION OF DIFFERENTIAL GPS USING ARDUINO

The thesis proposes the low-cost solution of Differential GPS using Arduino as a Master Control Unit. The thesis provides the methods of GPS position augmentation, which is available for varied applications such as drones or autonomous lawnmowers operated in a private sector. Used methods of GPS positioning accuracy improvements are based on a Satellite-Based Augmentation System (SBAS) and pseudorange residuals.

2.8 INTELLIGENT BUS MONITORING AND MANAGEMENT SYSTEM

Authors M. A. Habnnan, A. M.Mustapbha, A.Husjsain and H. Bgasri have practical the arrangement “Intelligent Management System and Bus Monitoring” The future system customs Artificial intelligence with the help of RFID module which is cast-off in-order to lessen the

physical effort carried out in the Automobile-Organization & Monitoring Organization. RFID is used to track the bus close to the bus stop. Hence the specific of the bus is not given , only the distance is shown at bus stop. The limitation of the project is accracy and it is important.

CHAPTER 3

SYSTEM DESIGN

The key aspect of this project is the way the bus stop knows about the distance of as moving target. This can be done in many ways but the way we decide to do is by using gps module and an nRF24L01+ PA/LNA module (to improve the range of the regular version).

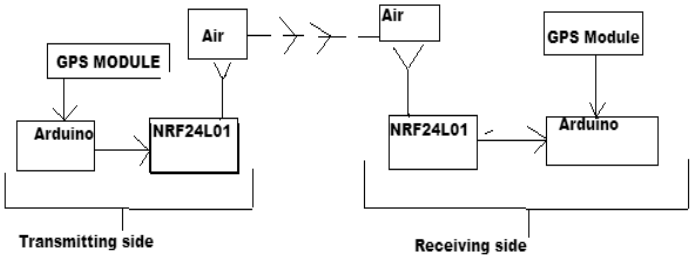

Fig.3.1 Block Diagram

The method used here is quit straight forward we use GPS module to get the real time latitudes and longitudes of the transmitting position in this case the bus then using an nRF24L01 trans receiver is transmitted and received at the bus stop where the latitude and longitudes are saved before hand of that location. When it receives the real time coordinate of the moving object then it calculates the distance between the coordinates using simple mathematics. And shows it in the lcd screen in the bus stop.

The scope of this project is limitless and the only key aspects of this project is how will the station know where the bus is! This problem can be dealt with by using different kind of approaches. But the solution which we are considering should give accurate result keeping in mind the cost factor as well. When we think of using the radio frequency band(2.4 GHz ISM) the key problem which came in mind is the climate as the transmitting signal is very much suspectable to rain and transmission can be total hinder by both lighting and rain fall. The way we can deal with rain and climate in general is beyond the scope of our project.

3.1 RF COMMUNICATION

- A radio frequency signal refers to signal which is wireless communication and work on electromagnetic signal used as a form of communication, if someone is discussing wireless electronics. Radio waves are a type of electromagnetic radiation with specified radio frequencies that range from 3kHz to 300 GHz. Frequency can be termed the spped of light is the rate of propagation 299 792 458 m / s and it does not allow air to travel form one place to another from one place to other. RF waves can generally naturally occur from from stars , sun flares, lightning, in space that radiate RF waves as they age. Human have choosen waves to communcate , these waves can osscilate in various frequencys. RF communication in most of the inductries include radar, television broadcasting systems, computer and mobile stage nets, far distance control, distant metering/monitoring, and many mush more.

- While individual radio components let say for example mixers,power amplifiers and filters can be classified based on their operating in these frequency range, they are not wireless standards at all (e.g. Wi-Fi, Bluetooth, etc.) as they only provide physical layer support. In contrast, RF modules, transceivers, and SoCs with always include DLL layer suppot for many wireless communcaiton protocals

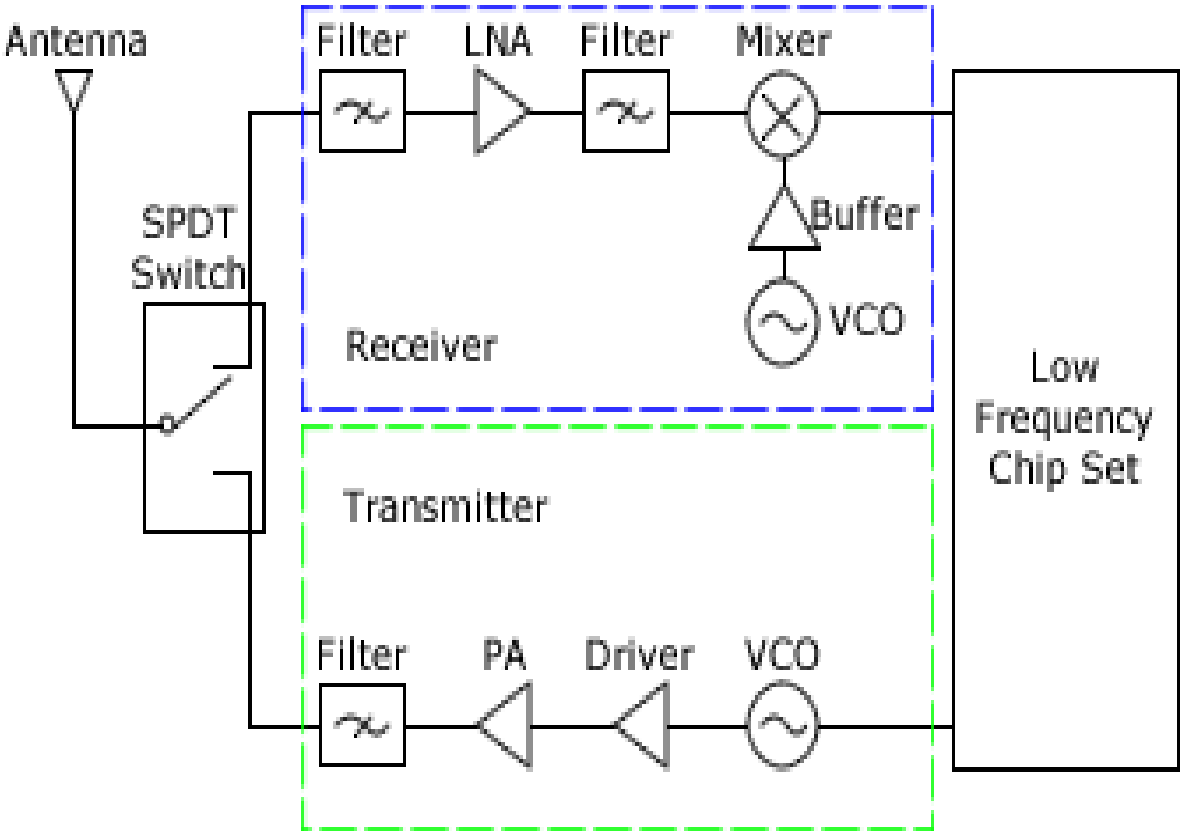

Fig. 3.2 Basic Block diagram For Radio Frequency Communcation Device

3.2 MAIN CATEGORIES FOR RADIOFREQUCENY COMMUNCATION

- Long Waves (LW): frequencies less than 300 kHz

These standing waves, named 'ground wave', are profoundly movies through the planets and are utilized for multiplexing across significant long distances. A normal recieving wire for lang wave transmission arrive at a tallness of 300 meter and more. As indicated by the TIU characterization, long wave are utilized mostly in India, US, the IRAN, the previous Soviet

Union, and Mongolia. IN these location the radio transmission is performed by AM (Amplitude Modulation).

- Medium Wave (MW) – range of frequencies is: 500-1600 kHz

Utilized basically significant distance canbe covered for medium was transmission. Before, radio broadcasts sending in this recurrence range enjoyed a benefit due to their capacity to communicate broadcasts to audience members in removed nations. These days, medium waves are utilized somewhat today on account of the simplicity of communicating through overseas links and the Internet. Their use is limited in light of air resistance in the ionosphere throughout the changes amongst day and night and amid seasons (Band 6 in the IUT's Table of Frequencies and Uses)

- Short Wave (SW) – range of frequencies is: 1.7 – 30 MHz

Short wave were utilized in numerous nations, typically by radio broadcasts, for broadcast of substance communicates over significant difference. Frequencies around by 27 MHz are utilized for individual radio frequency transmission. The SW range is likewise the wellspring of RF signals in MRI frameworks for nonintrusive examining in clinical analysis and exploration. Additional utilization of this scope of frequencies (as in additional recurrence varieties depicted beneath) is for following and recognizable proof at departures from supplies utilizing RF Identification (RFID) frameworks for example to forestall burglaries or for robotized distinguishing proof of representatives incoming and sendoff. Extra uses include: plastic fusing frameworks, warming by acceptance, and so on This scope of RF is likewise utilized for correspondence by beginner radio aces situated in various nations.

- Very High Frequency (VHF) used for radio broadcasting - range: 30-88 MHz

The VHF(Very High Frequency**)** range is utilized for strategic correspondence by armed force wireless in the Israel Defense Forces(IDF) and numerous additional military all through the biosphere. VHF(Very High Frequency**)** is a wellspring of wireless signs in MIR frameworks, and is utilized in RF Identification (RFID) frameworks aimed at following then ID (See additionally overhead, below brief wave range).

- Very High Frequency (VHF) aimed at analog radio propagation - ranges: 88-108 MHz

Additionally named FM (Frequency Modulation) wireless, this recurrence variety is utilized for Frequency Modulation transmission. It is likewise a wellspring of RF signs in MRI frameworks and in environment locator.

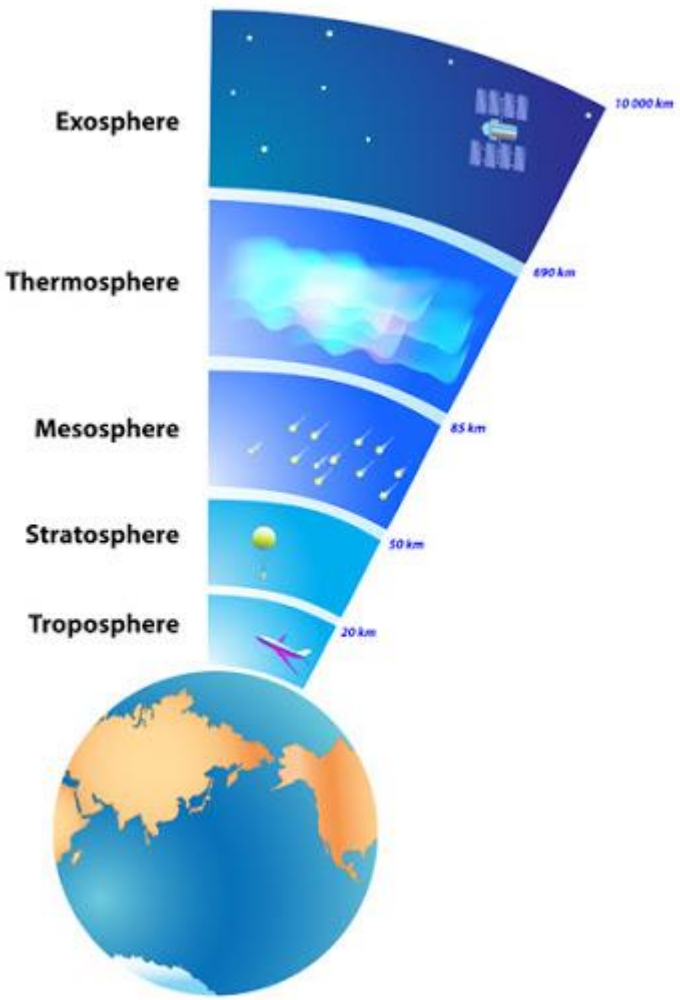

Fig.3.3 Various layers of atmosphere

Cellular message nets, analog and digital mobile earphones, and maritime and atmosphere locator.

These frequency varieties are utilized through cell base positions and for the neighborhood, metropolitan, rustic, public and worldwide sending of cell organizations' framework . Cell

phones ages (counting progressed Long-Term Evolution, LTE) - work in the 800 MHz, 2100 MHz, 1800 MHz recurrence varieties, and at tall recurrence about 2.6 GHz or more, separately. Satellite wireless, works at 121.5 – 2304 MHz; following and recognizable proof radar frameworks work in the scope of 1.1 GHz - 2.49 GHz; maritime locator works in the scope of 1.50-1.65 GHz; air terminal locator works in the 2-8 GHz variety; military locator works in the 1 GHz-3 GHz range (as per the various groups in the IUU arrangement table). further developed radar frameworks may likewise work at advanced frequencies.

- WiFi along with Bluetooth data message– frequency ranges: 2.5 GHz, 6 GHz and others.

WiFi incidences are utilized for the broadcast of information bundles, fundamentally on the Net. Information correspondence is achieved by worldwide normal correspondence conventions, (for example, 802.21b, 802.31g and 8022.11n). For instance, see 802.11AC, which is the convention with WiFi information correspondence in the 5.01 GHz range. Bluetooth likewise works at very high frequencies, generally at 2.5 GHz

- Tuner domestic telephones and microwave kilns – frequency ranges: 5.7 GHz, 2.6 GHz, 810-910 MHz.

Innovative developments presented the utilization of remote family phones working with these incidences to supplant cable telephones. Domestic microwaves work at 2.41 GHz. Additional quickly creating utilization of these incidences is in keen KM.

- Message satellite broadcasting and locator (very high frequency and extremely very high frequency): 10 Ghz and higher

At incidences over 10.2 GHz, the vulnerability of radio surfs is basically the same as that of bright beams, i.e., slightly obstruction (for example foothills, structures) that meddles with the section of bright waves will likewise generally block radio frequency energy in this recurrence variety. Subsequently, correspondence at very high and incredibly very high incidences over

10.1 GHz needs visual view and requires more fastidious arranging in the organization thickness of energy bases, to conquer geological obstructions as well as structures in metropolitan zones, and guarantee better remote correspondence in this recurrence range. Correspondence recurrence variety is exceptionally reliant upon the bodily and barometrical vulnerability between the spreader and beneficiary.

3.3 MICROWAVE FREQUENCY BAND

L Band

L groups are consuming a recurrence difference amid 1.0 GHz to 2.2 GHz and their frequency in open space is 16cm to 31cm. These scopes of surfs are utilized in routes, GSM cell earphones, and in armed requests. They can be utilized toward quantify the dirt dampness of tropical jungles.

S Band

S-band microwave oven are consuming a recurrence range between 2.2 GHz to 4.4 GHz and their frequency range is 7.5cm to 15 cm. These surfs can be utilized in route guides, optical correspondences, then remote organizations.

C Band

C band surfs are consuming a reach between 4.0 GHz to 8.0 GHz and their frequency is between 3.76 cm to 7.54 cm. C band microwave oven enter blocks, powder, fume, snowflake, and downpour toward uncover the world's superficial. These heats waves can be utilized in significant difference radio media communications.

X Band

The recurrence good for S-band microwaves is 8.1 GHz to 12.1 GHz having a frequency between 24 mm to 37.4 mm. These sprays are utilized in cable

correspondences, wide band interchanges, locators, interplanetary interchanges, and novice wireless signs.

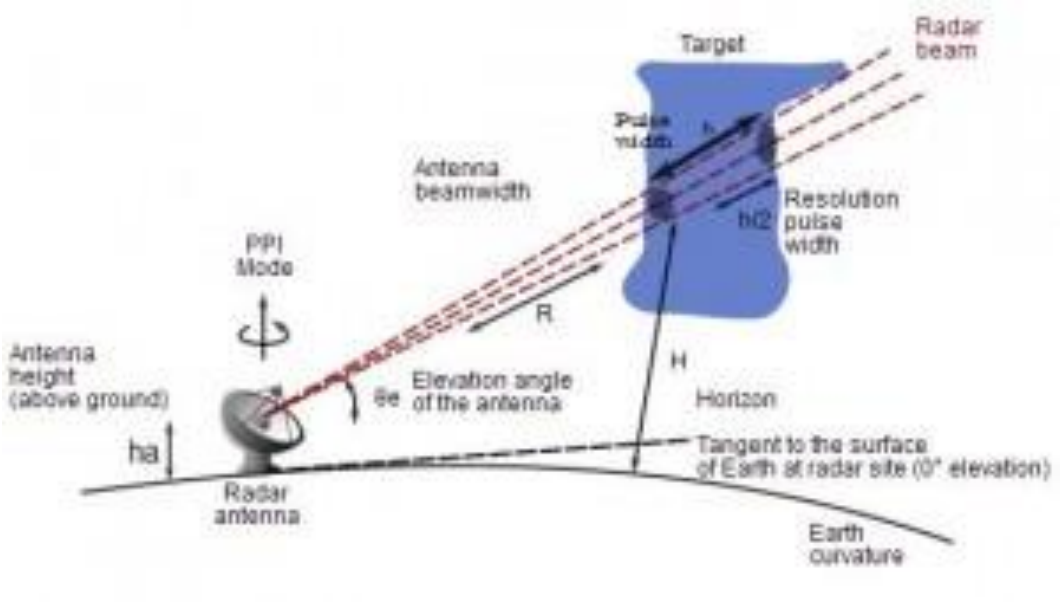

Fig. 3.4 Applications using Microwaves

Ku Band

These waves are involving the recurrence range between 12 GHz to 18 GHz and having a frequency of between 16.7 mm to 25 mm. "Ku" alludes to Quartz-under. These waves are utilized in satellite interchanges for estimating the progressions in the energy of the microwave heartbeats and they can decide the speed and heading of wind close to seaside zones.

K Band with Ka Band

recurrence range for K band waves is between 18.1 GHz to 26.3 GHz. These waves are having a frequency between 11.2 mm to 16.4 mm. with this Ka band the recurrence difference is 26.6 GHz to 40.1 GHz and they are possessing the frequency

between 5 mm to 11.3 mm. These waves are utilized in satellite correspondences, cosmic perceptions, and radars. Radars in this recurrence range give short-range, high goal, and high measures of information at the recharging rate.

V Band

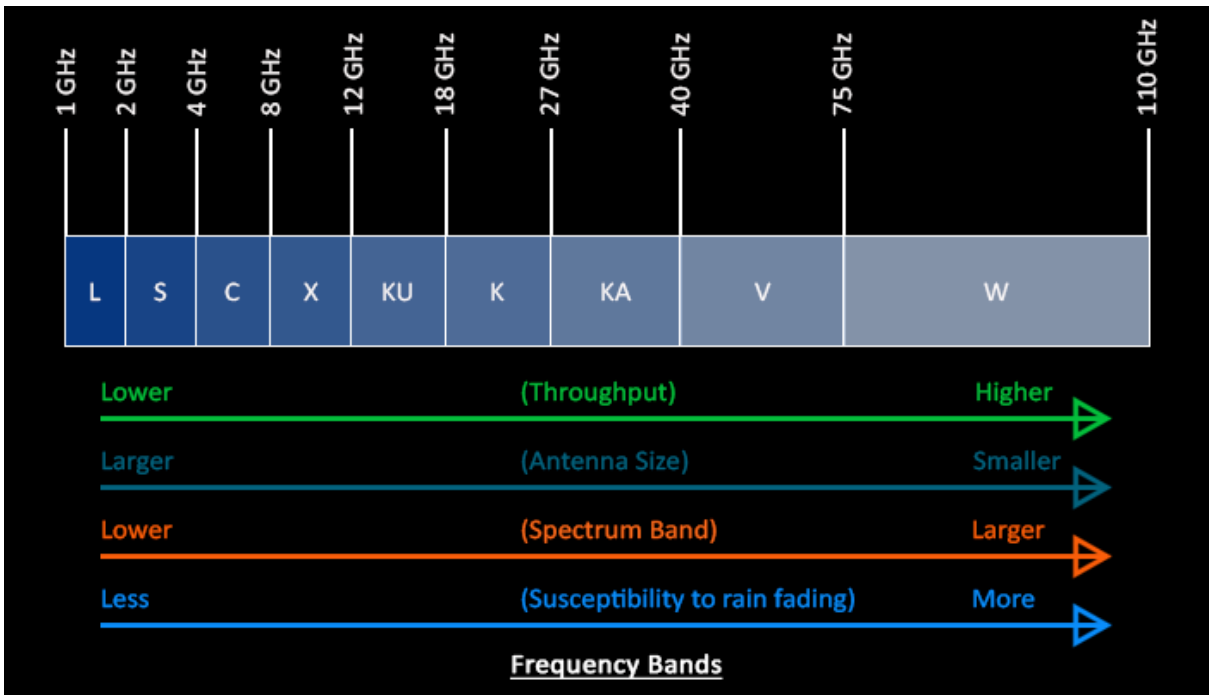

Fig 3.5 Frequency band

Band	Frequency Range (GHz)
L	1 to 2
S	2 to 4
C	4 to 8
X	8 to 10
Ku	12 to 18
K	18 to 26.5
Ka	26.5 to 40
Q	30 to 50
U	40 to 60
V	50 to 75
E	60 to 90 (millimeter waves)
W	75 to 110
F	90 to 140
D	110 to 170

3.3 RADIO PROPOGATION

3.3.1 GROUND WAVE PROPOGATION

Ground wave proliferation is an illustration of radio engendering which is generally called as surface wave. These waves spread over the world's surface in low and medium frequencies. They are basically utilized for transmission between the outside of the ionosphere and earth.Ionosphere is important for air where correspondence happen These are comprised of the quantity of constituent waves.

The motivation behind why it is known as a ground wave is that it is the amount of the waves that are reflected by the world's surface or any slopes. The waves follow the arch of the earth, empowering them to cover into the great beyond. Into the great beyond, the waves get hindered by the ebb and flow of the earth and the signs are delivered by the diffracted surface wave.

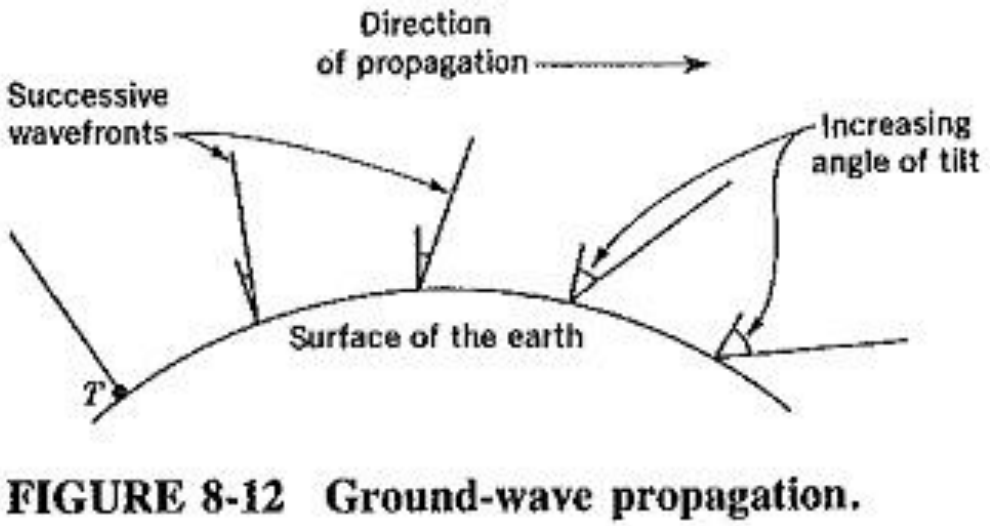

FIGURE 8-12 Ground-wave propagation.

Fig 3.6 Ground wave propagation

Benefits of Ground Wave Propagation

- These waves tend to twist around the corners or checks during engendering which makes them more productive and furthermore these are not influenced by the adjustment of air conditions.

Hindrances of Ground Wave Propagation

- High-recurrence waves can't be communicated as the energy misfortunes are more a result of the ingestion of energy in the world's environment.

- These are utilized to cover short ranges and furthermore includes lessening of waves as they cooperate with the whirlpool flows delivered by the outside of the earth.

Uses of ground wave popagation

- These can be utilized for single direction correspondence from the military to lowered submarines as they infiltrate to a huge profundity into seawater.

- AM, FM and TV broadcasting should be possible with the assistance of ground waves.

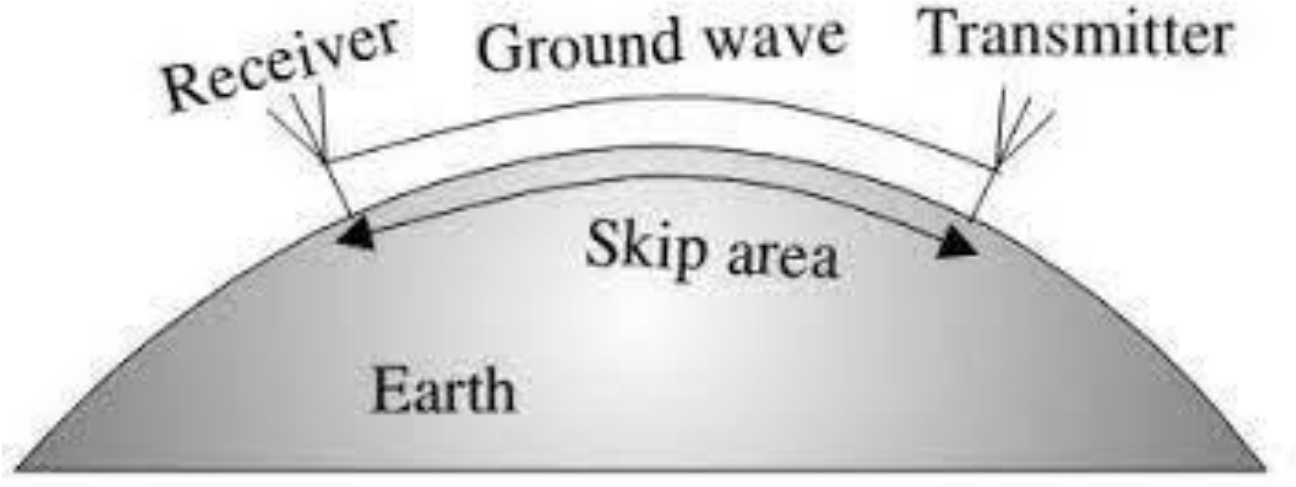

Fig. 3.6 Ground wave propagation

3.3.2 SPACE WAVE PROPOGATION

Sky wave engendering is one of the radio wave spread. It is characterized as the conduct of radio waves as they proliferate starting with one point then onto the next or into different

pieces of the climate.Space wave engendering is characterized for the radio waves that happen inside the 20km of the air ie; lower atmosphere, including an immediate and reflected waves. These waves are otherwise called tropospheric spread as they can travel straightforwardly from the world's surface to the lower atmosphere surface of the earth. It is otherwise called a view proliferation as the signs are sent in an orderly fashion from the transmitter to the beneficiary.

To forestall lessening and loss of sign strength, the stature of the radio wires and distance between them can be given as:

$D_m = (2RH_t)^{-½} + (2RH_r)^{-½}$

Where,

D_m: distance between the two antennas

R: radius of the earth

H_t: height of transmission antenna

H_r: height of receiver antenna

Applications of space wave propagation

It is utilized in different correspondence frameworks like

- A view correspondence and satellite correspondence
- Radar correspondence
- Microwave connecting

Space wave propagation limitations

- These waves are influenced by the ebb and flow of the eart
- The proliferation of these waves occurs along the view distance which is characterized as the distance between the sending radio wire and the getting recieving wire which is otherwise called the scope of correspondence

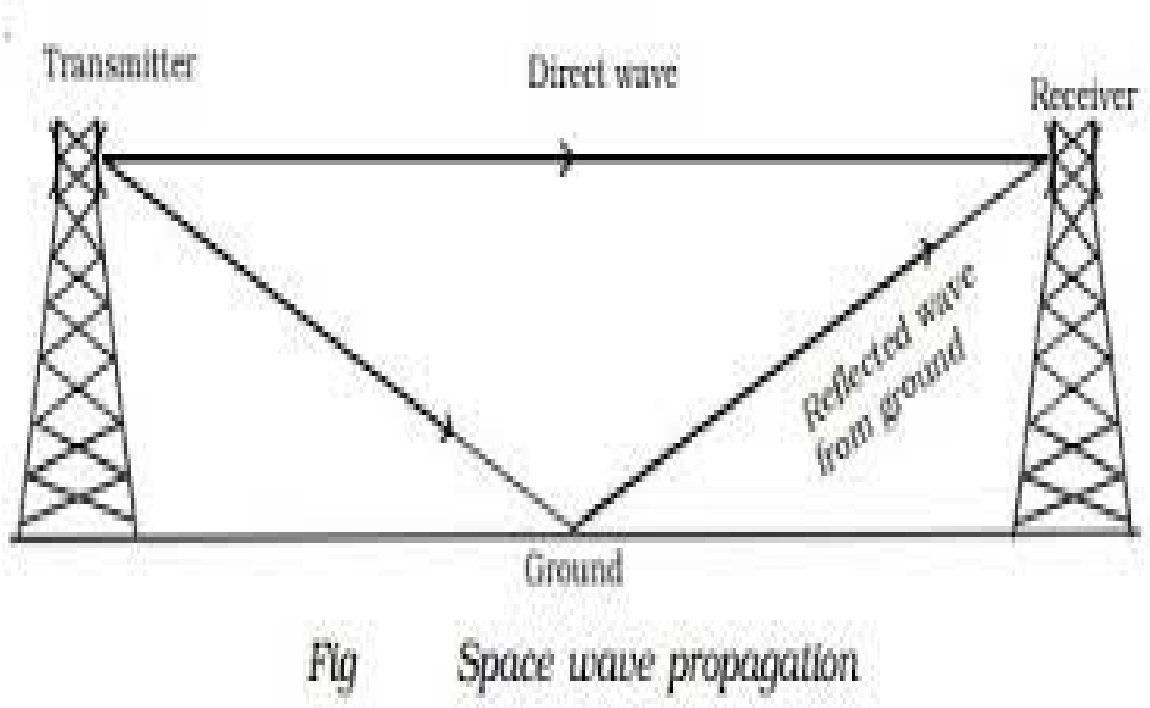

Fig. 3.7 Space wave propagation

3.3.3 SKY WAVE PROPOGATION

In radio correspondence, skywave or skip alludes to the engendering of radio waves reflected or refracted back toward Earth from the ionosphere, an electrically charged layer of the upper air. Since it isn't restricted by the bend of the Earth, skywave spread can be utilized to impart into the great beyond, at intercontinental distances. It is for the most part utilized in the shortwave recurrence groups.

Because of skywave proliferation, a sign from an inaccessible AM communicating place, a shortwave place, during irregular Electric field engendering circumstances (mainly throughout the late spring a very long time in the two halves of the globe) a removed VHF FM or

Television slot – can here and there be gotten as obviously as neighborhood stations. Most significant distance shortwave (high recurrence) radio correspondence – somewhere in the range of 3.1 and 30.1 MHz – is a consequence of sky wave engendering. Since the mid 1920 beginner wireless administrators (or "hams"), restricted to bring down sending power than transmission stations, enjoy take benefit of sky wave for significant difference (or "DX") correspondence.

Skywave broadcast is different from:

- Tropospheric disperse, elective technique for accomplishing into the great beyond broadcast at very higher frequencies
- Ground wave spread, where wireless waves moves along Earth's surface deprived of being reflected or the refracted by the environment – the predominant engendering at very frequency.
- View spread, in radio waves portable in an orderly fashion, the prevailing mode at very higher frequencies

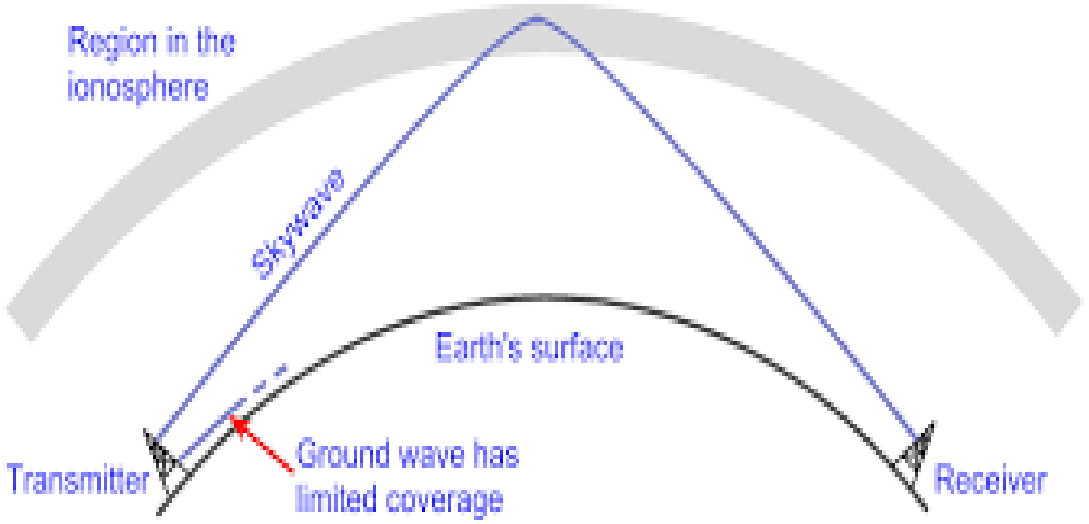

Fig 3.8 Sky wave prpagation

3.3.4 DUCTWAVE PROPOGATION

A radio wave spread strategy that permits the transmission of UHF and VHF electromagnetic waves through the area close the tropospheric layer of climate is known as channel engendering. Fundamentally in channel proliferation, in spite of being reflected from the ionosphere or skimming over the outside of the earth, the waves engender from a finish to another by going through progressive refraction from the lower atmosphere. Channel engendering is now and then alluded as super refraction. Duct propogation the proliferation of the signs into the great beyond. This implies that dissimilar to surface wave spread, it allows the sign transmission without guaranteeing the requirement for having a view distance between the two recieving wires

Need for Duct propogation

- We are now mindful of the way that for recurrence ranges more prominent than 30MHz, space wave spread is utilized. This is so in light of the fact that such high-recurrence signals regardless of getting reflected from the ionosphere get entered.

- Accordingly space wave is used for communicating high-recurrence signals. Be that as it may, the significant downside related with space wave engendering was LOS correspondence.

- Because of high recurrence, the signs in the lower atmosphere require a check free way as frequencies of such high-recurrence signals are short. Consequently this method of spread restricts the reach for signal transmission.

- Along these lines, for UHF and VHF signal transmission to a considerably more noteworthy distance, the pipe present in the tropospheric area of the climate is used. This pipe goes about as a channel to direct the high-recurrence wave to the opposite end by progressive refraction.

- Subsequently is alluded as super refraction.

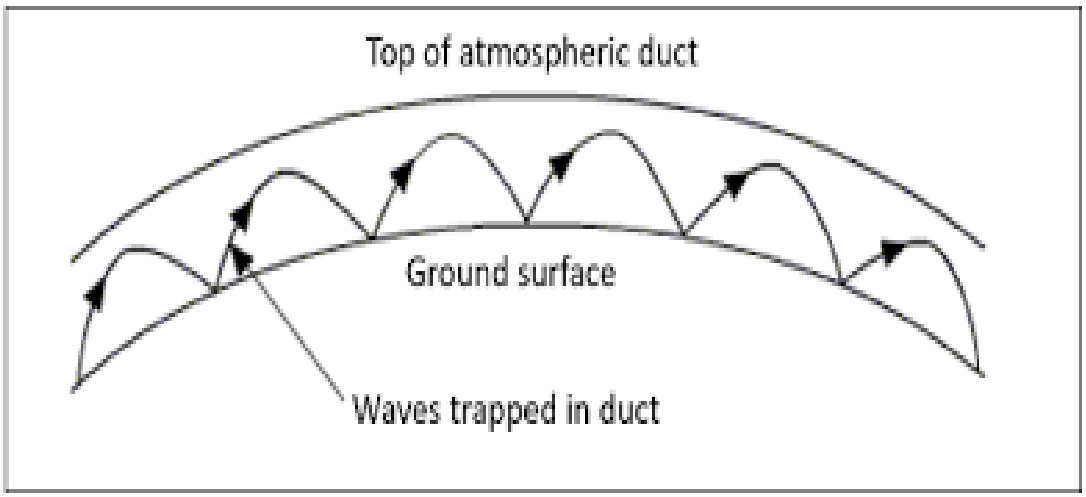

Fig 3.9 ORBIT for Satellite Communication

1 Geo Orbit

A Geostationary orbit , also know as a geosynchronous tropical orbit[a] (GEO), is a round circle in elevation over Earth's equator and following the heading of Earth's pivot. In our project we are using Geosynchronous satellite

Period taken by it to cover an orbit equivalent to the World's rotational period,on a real day thus to people on earth it seem like its immobile, in a permanent situation in the sky. The researchh about geostationary circle was brought by sci-fi author Arthur C. Clarke during the

1940s as an approach to change media communications, and the main spaace station to be put in this sort of circle was dispatched in 1963.

Interchanges satellites are frequently positioned in a circle so that Earth-based space station recieving wires present on surface of earth don't need to . Climate satellites are additionally positioned in this circle for ongoing observing and information assortment, and route satellites to give a realized adjustment point and upgrade GPS precision.

These satellites usead for geostationary purpose are dispatched through an impermanent circle, and put in a space over a particular time on the World's surface. The circle has to maintain keeping of station , and present satellites resigned are set in a higher cemetery circle to stay away from crashes**.**

USES

- Geostationary orbits of 36,000km from the Earth's equator are are most famously known for many satellites used for various forms of inter-communication, including TV. . For twlwcommunication to happen it has to have proper line of sight and satellite has to be immobile

- An overall organization of functioning geostationary satellites used for purrpose of meteorology is utilized to give noticeable and IR pictures of surface of Earth and environment for climate perception, study of ocean, and barometrical following. Starting at 2019 there are 19 satellites in one or the other activity or backup These satellites ordinarily catches pictures in the range within visual and infrareed with a spatial goal somewhere in the range of 0.5 and 4 square kilometers.Some of them are;
- the United States' GOES series, operated by NOAA
- the Meteosat series, launched by the European Space Agency and operated by the European Weather Satellite Organization, EUMETSAT
- the Republic of Korea COMS-1 and[30] GK-2A multi mission satellites.

- the Russian Elektro-L satellites
- the Japanese Himawari series
- Chinese Fengyun series
- India's INSAT series
- Satellites which are geostationary can be utilized to increase Global navigation satellite system frameworks by transferring mistake rectifications (determined from base stations of a known position) and giving an extra base signal which can be used as reference. This advances position exactness from roughly 5m to 1m or maybe less

Implementation

- Launch

  Satellites used for geostationary purpose are dispatched toward the east into a circle that coordinates with the pivot pace of the equator. The least tendency that a satellite can be dispatched into is that of the dispatch into scope of site, so dispatching the satellite from near as far as possible the measure of tendency change required later. Additionally, dispatching from near the equator permits the velocity of the Earth's revolution to lift satellite. A dispatch site ought to have liquid or barren land toward the east, so any bombed propulsion system don't on a populated territory

- Orbit Allocation

  Geostationary Satellite should all possess a solitary ring over the equator. The prerequisite to seperate these space station separated, to stay away from unsafe radio-recurrence impedance during tasks, implies that there are a set number of spatial openings accessible, and hence just a predetermined integer of satellites can be worked in circle geostationary satellite. This has prompted struggle between various nations wishing admittance to similar orbital openings (nations close to a similar longitude yet contrasting scopes) and frequency of RF range. These questions are done by International Telecommunication Union's(ITU) portion system under the Regulations

for radio. In the 1976 Bogota Declaration, 8 nations situated on the equator of earth guaranteed power over the geostationary circles over their domain, however the cases acquired no worldwide acknowledgment.

Properties

- Inclination

  A tendency of zero guarantees that the circle stays above the equator consistently, making it fixed regarding scope according to the perspective of a ground onlooker

- Period

The period of orbit is equivalent to precisely one real day basis. This implies that the space station will get back to a similar point over the surface of earth each (sidereal) day, paying little mind to other properties of orbit . For a geostationary satellite circle specifically, it guarantees that it holds a same longitude for larger time. This period taken by orbit, T, is straightforwardly identified with the semi-significant pivot of the circle through the fprmula:

$$T = 2\pi\sqrt{\frac{a^3}{\mu}}$$

where a is orbit's semi-major axis length

- Eccentricity

The eccentricity is zero, which creates a roundabout circle. This guarantees that the satellite doesn't draw nearer or further away from the Earth, which would make it track in reverse and advances across the sky

- Orbital stability

- A geostationary circle can be accomplished uniquely at a height exceptionally near 35,786 kilometers (22,236 miles) and straight over the equator. This compares to an velocity of orbit of 3.07 kilometers every second (1.91 miles every 1/60 of minute) and an orbital time of 1,436 minute, one sidereal day. This guarantees that the space station will coordinate with the Earth's period of rotation and has a permanent impression on the ground. All satellites used for geostationary purpose must be situated on this ring.

- A mix of gravity from moon, sun based gravity, and the positioning of the Earth t its posts causes a movement along the orbital plane of any item which is geostationary, with an circular time of around 53 years and an underlying tendency slope of about 0.89 each year, accomplishing a maximal tendency of 16-1° after 26.5 years. To address for this annoyance, customary stationkeeping of orbit moves are important, adding up to a v-delta of around 50 m/s per year.

- A subsequent impact to be considered is the float which is longitudinal, brought about by the latitudinal of the Earth – the equator is marginally geoid. There are two firm balance focuses (at 75.5°E and 109°W) and 2 relating flimsy focuses (at 165.3°E and 14.7°W). Any item which is geostationary positioned between the balance focuses would (with no activity) be gradually sped up towards the steady harmony position, causing an intermittent variation in longitude coordinate. The amendment of this impact requires station-keeping moves with a maximal v-delta of around 2 m/s each year, contingent upon the ideal longitude.

    - Sunlight based breeze and radiation pressure additionally apply little powers on satellites: over the long run, these reason them to gradually float away from their recommended orbits.

    - Without overhauling missions from the Earth or an inexhaustible impetus technique, the utilization of engine charge for places where station is kept an impediment on the satellite lifetime. Lobby impact engines, which are right now

being used, can possibly delay the help satellite lifetime by giving high-proficiency drive which is electric A geostationary circle can be accomplished uniquely at a height exceptionally near 35,786 kilometers (22,276 miles) and straight over the equator. This compares to an circular speed of 3.07 kilometers each second (1.91 miles each second) and an time taken by orbit of 1,436 minutes, one sidereal day. This guarantees that the satellite will coordinate with the Earth's period of rotation and has a fixed impression on the ground. All satellites for geostationary purpose must be situated on this orbit.

- A mix of gravity from moon,gravity from sun , and the positioning of the Earth at its posts causes a precession movement of the plane along ring of any item which is geostationary, with an orbital time of around 53 years and an underlying tendency slope of about 0.85° each year, accomplishing a maximal tendency of 15° after 28years. To address for this annoyance, customary orbital keeping of station moves are important, adding up to a v-delta of roughly 50 m/s per year.

- A subsequent impact to be considered is the latitudinall float, brought about by the lopsidedness of the Earth – the equator is marginally elliptical. There are two stable balance focuses (at 75°E and 118°W) and two relating flimsy focuses (at 167°E and 15°W). Geostationary item positioned between the balance focuses would (with no activity) be gradually sped up towards the steady harmony position, causing an intermittent variation longitudinally. The amendment of this impact requires keeping of station moves with a maximal v-delta of around 2 m/s each year, contingent upon the ideal latitude

- Sunlight based breeze and radiation pressure additionally apply little powers on satellites: over the long run, these reason them to gradually float away from their recommended orbits.

- Without overhauling missions from the Earth or an inexhaustible impetus technique, the utilization of engine charge for places where station are kept an impediment on the satellite lifetime. Lobby impact engines, which are right now being used, can possibly delay the help satellite lifetime by giving high-proficiency on drive which is electric

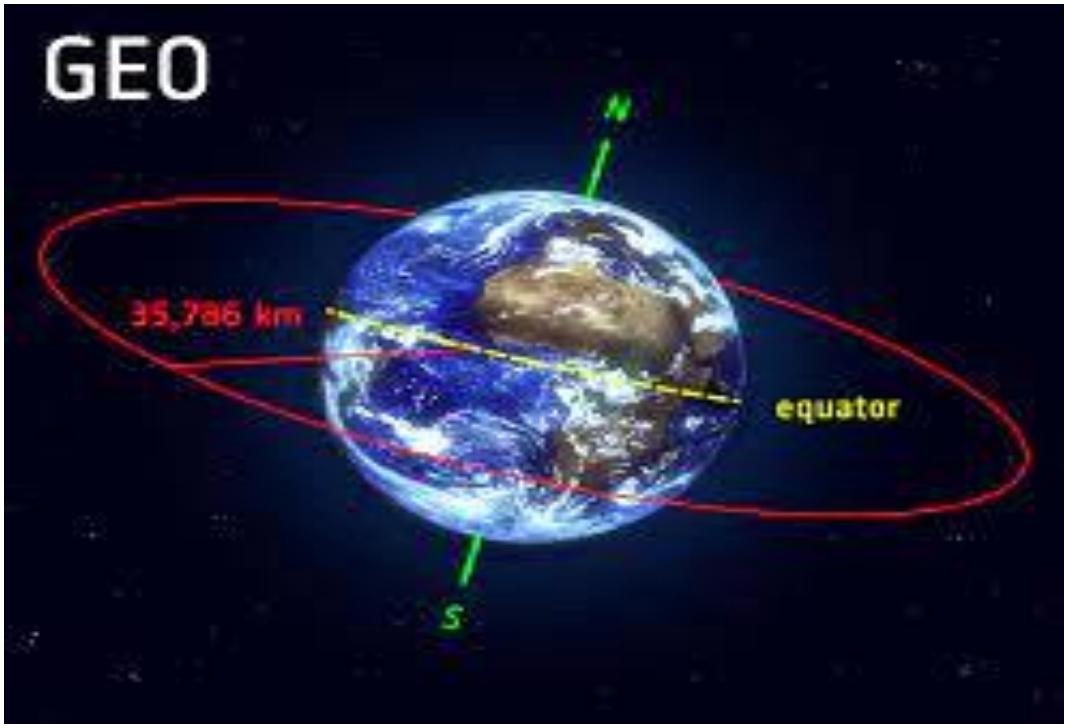

Fig 3.10 Geosynchrous earth orbit

3.3.5 MEDIUM EARTH ORBIT

A Medium Earth orbit (MEO), is an\ circle focussed on earth with an elevation over a low Earth orbit (LEO) and under a high Earth circle (HEO) – between 2,000 km (1,243 mi) and 35,786 km (22,236 mi) above ocean level).The limit among MEO and LEO is a discretionary height picked by acknowledged show while the limit among MEO and HEO is the specific elevation of a geosynchronous circle, where a satellite requires 24 hours to circle the Earth, a similar period as the World's own turn. All satellites in MEO have an orbital time of under 24 hours, with the base time frame (for a roundabout circle at the most reduced MEO elevation) around 2 hours.Satellites in MEO orbit are irritated by sunlight-based radiation pressure which is the overwhelming non-gravitational bothering force.Other annoying powers include: Earth's albedo, route radio wire push, and warm impacts identified with heat re-radiation. The MEO area incorporates the two zones of fiery charged particles over the equator known as the Van Allen radiation belts, which can harm satellites' electronic frameworks without uncommon shielding.A medium Earth circle is at times called mid Earth orbit or halfway roundabout circle (ICO)

USES

- Two medium Earth circles are especially critical. A satellite in the Semi-coordinated circle at a height of around 20,200 kilometers (12,600 mi) has an orbital time of 12 hours and is absurd two spots on the equator each day.

- This dependably unsurprising circle is utilized by the Worldwide Situating Framework (GPS) constellation

- Other route satellite frameworks utilize comparable medium Earth circles including Glonass (with an elevation of 19,100 kilometers (11,900 mi)), Galileo (with an elevation of 23,222 kilometers (14,429 mi))[6] and BeiDou (with an elevation of 21,528 kilometers (13,377 mi)).

- The Molniya circle has a high tendency of 63.4° and high whimsy of 0.722 with a time of 12 hours, so a satellite burns through the vast majority of its circle over the picked region in high scopes. This circle was utilized by the (presently dead) North Americas

Satellite Radio named Sirius and Radio satellites and the Russian Molniya military correspondences satellites after which it is named.

- Correspondences satellites in MEO incorporate the O3b and impending O3b mPOWER groups of stars for broadcast communications and information backhaul to sea, air and distant areas (with an elevation of 8,063 kilometers (5,010 mi)Interchanges satellites to cover the North and South Pole are likewise placed in MEO.

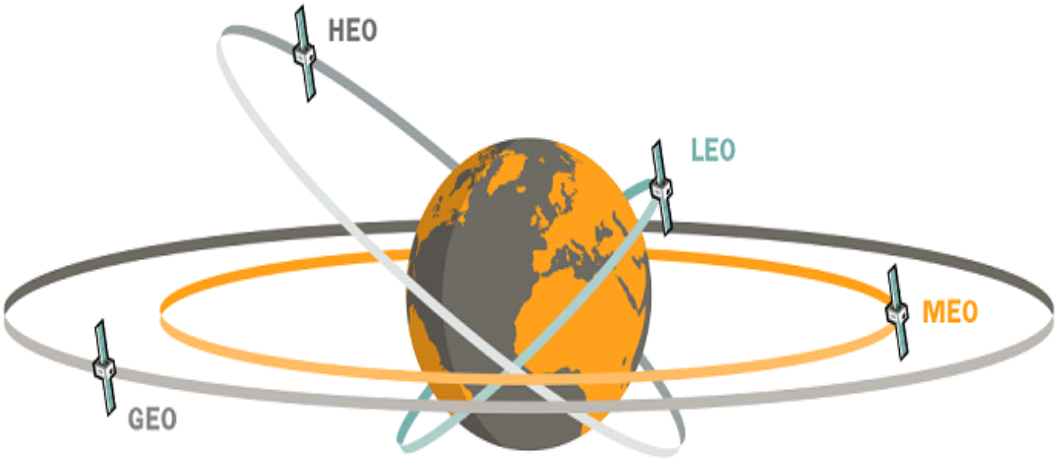

Fig 3.11 Varous orbits of satelites

3.3.6 LOW EARTH ORBIT

A low Earth circle (LEO) is an circle focussing on Earth near the planet, regularly determined as an time taken to cover orbit of 129 minutes approx or less (making atleast 11.25 circles each day) and an unusualness under 0.25.The greater part of the counterfeit articles in space are in LEO, with a height always less than around 33% of the sweep of the Earth. The expression "LEO locale" is additionally utilized for the space of room under a altitude of 2,000 km(approx 33% of the sweep of Earth).Articles in circles which go through this space, regardless of whether they have an apogee farther, or are semi-orbital, are painstakingly followed in light of the fact that they present a crash hazard to the numerous space station in LEO.All maintained satellite to date have been in LEO. From 1968 to 1972 the moon missions known as Appollo program sent people past LEO. Since the finish of the Apollo program there is no attept to human spaceflights past LEO

USES

- A low Earth circle (LEO) is an Earth-focused circle near the planet, regularly determined as an time to cover orbit of 138 minutes or less (making least 11.25 circles each day) and an unusualness under 0.25. The greater part of the counterfeit articles in space are in LEO, with a height never more than around 33% of the sweep of the Earth.
- The expression "LEO locale" is additionally utilized for the space of room under a altitude of 2,000 km (1,200 mi) (around 33% of the sweep of Earth). Articles in circles which go through this space, regardless of whether they have an apogee farther, or are sub-orbital, are painstakingly followed in light of the fact that they present a crash hazard to the numerous spacestation in LEO.
- All maintained space stations to date have been in LEO. From 1968 to 1972 the lunar missions named Apollo program's sent people past LEO. Since the finish of the Apollo program there have been no attept to human spaceflights past LEO

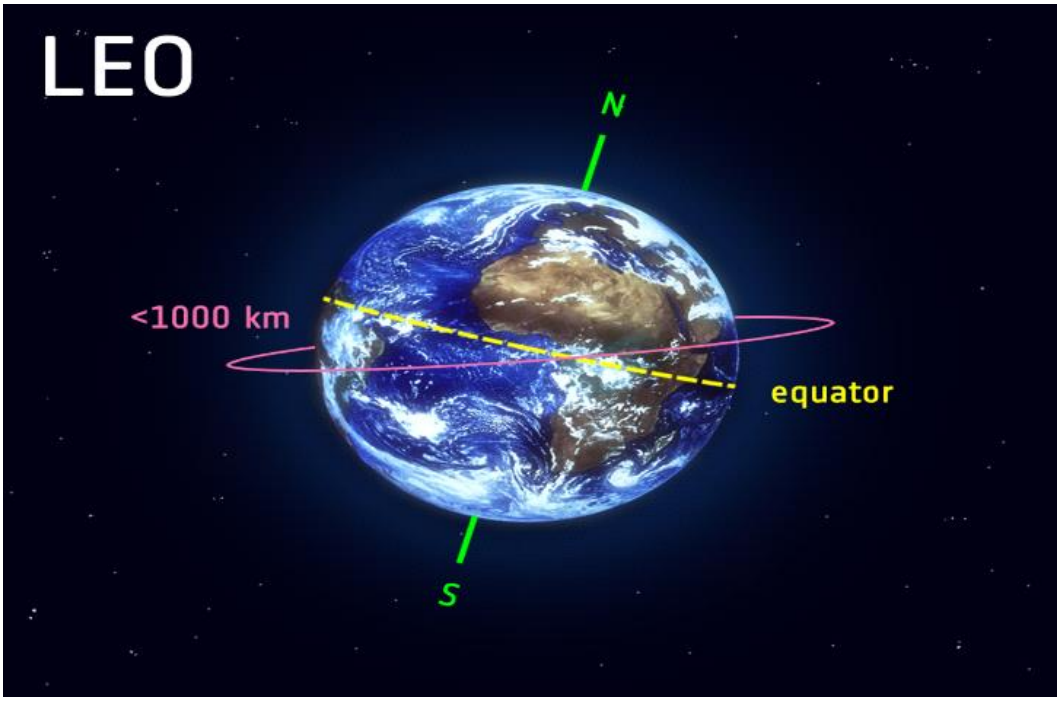

Fig 3.12 Lower earth orbit

CHAPTER 4

SYSTEM ANALYSIS

Here is the step wise functioning of each equipment used:

4.1 GPS MODULE

- The gps module used is a NEO-6M GPS. Which has the following parameters.

Receiver Type	50 channels, GPS L1(1575.42Mhz)
Horizontal Position Accuracy	2.5m
Navigation Update Rate	1HZ (5Hz maximum)
Capture Time	Cool start: 27sHot start: 1s
Navigation Sensitivity	-161dBm
Communication Protocol	NMEA, UBX Binary, RTCM
Serial Baud Rate	4800-230400 (default 9600)
Operating Temperature	-40°C ~ 85°C
Operating Voltage	2.7V ~ 3.6V
Operating Current	45mA
TXD/RXD Impedance	510Ω

- The GPS module used the NEMA sentence.National Marine Electronics Association in short called as NMEA. This is a most used message format for almost all GPS receivers.
- We have to understand NMEA sentences into useful human information. To make our our work easy, we use a library called TinyGPS++ library.
- Arduino project has ability to detect destination latitude and longitude with accuracy with NEO-6M GPS Module that can communicate up to 21 satellites and identifies exact coordinate\ anywhere in the world.
- It give our Arduino project ability to locate locations with NEO-6M GPS Module which will communicate with upto 21 satellites and identifies locations anyplace within the world. It's going to function an magnificent device for anyone wanting to urge into the planet of GPS. they're low power (suitable for battery steam-powered devices), cheap, simple to interface with and area unit insanely well-liked among hobbyists.

- GPS receivers really work by deciding however so much they're from variety of satellites. square measure they're already programmed to detect wherever GPS device is
- The satellites does transmission concerning their location the present time within the sort of radio signals throughout the world.
- The receiver then does algorithm how much distance every satellite is by looking out how long it took for the signals to arrive. Once it's information on however distant a minimum of 3 satellites area unit and wherever they're in house, it will pinpoint your location on Earth.
- At the heart of the module is a NEO-6M GPS chip.
- NEO-6M GPS Module Chip
- It will communicate with twenty two satellites on 50 channels and achieves the theoretical highest level of sensitivity i.e. -161 dB, whereas overwhelming 45mA offer current.
- Unlike many GPS modules, it will do five location updates a 1/60 minute with two,5m position accuracy horizontally. Positioning engine additionally boasts a Time-To-First-Fix (TTFF) of below one second.
- Most important options the chip provides is Power Save Mode(PSM). It provide discount in power consumed by system by turning shift elements of the receiver ON and OFF. This drastically reduces power consumed by system to only 11mA creating it appropriate for power consuming applications like GPS wrist watch.
- The important pins of GPS chip used (neo-6M module)ar broken bent a zero.1″ pitch headers. This includes pins important for communication with a microcontroller . The GPS module can take information measure from 4800bps to 630400bps with default information measure of 9600.This method is understood as Trilateration. The dataobtained are NMEA sentence
- NMEA is AN descriptor for the NPSA. this is a typical message format for almost all GPS receivers.

- The NMEA commonplace is formatted according to information referred to as sentences. every sentence is separated by comma to make it easier for computer and microcontroller to understand

4.2 NRF24L01

- It is radio frequency transmitter and receiver which uses the ISM 2.4Ghz band for communication
- The role of this module in our project is simple it has to transmit serially at an approximate range of 800m, there is a bunch of information which has to be transmitted. So have decide to create a structure object in C language and transmit it serially using this module. With the help of structure (a concept of c language) all the parameter which define a bus were placed as a single unit and then transmitted. This helps the receiver to differentiate between various parameters of a single unit.

  Using two arduino board for wireless communication can be used for like remotely watching sensing element knowledge, home automation, dominant robots, and therefore the list goes on. And once it comes right down to having cheap nonetheless reliable.Once it beacome cheap and reliable there is no competitor for it
- nRF24L01+ (plus) transceiver module will typically be obtained on-line for fewer than 2 greenbacks, creating it one among the foremost cheap digital communication choices that you simply will get.
- 2.4 gigahertz band is one in every of the economic, Scientific, and Medical (ISM) bands reserved internationally for the utilization of unauthorised powerless devices. Examples ar conductor phones, Bluetooth devices, close to field communication (NFC) devices, and wireless pc networks (WiFi) all use the philosophy frequencies.
- The SPI bus is based on a Master and Slave, in most applications our Arduino is that the Master and nRF24L01+ transceiver module is that the Slave. slaves on the SPI bus

is proscribed unlike i2c bus, on the Arduino Uno you'll be able to use a most of 2 SPI slaves i.e. 2 nRF24L01+ transceiver modules.

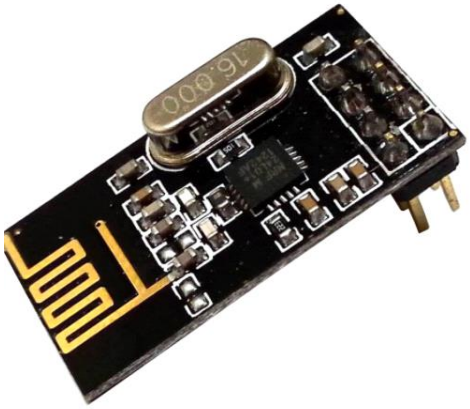

Fig 4.1 Nrf module

4.3 TINYGPS++ AND OTHER HEADER FILES

- This header file is the backbone of our project and is capable of handling some very complicated tasks such as calculating the time, latitude and longitude, speed etc.
- The transmitter in our project uses this gps header file of Arduino and send the data serially through free space.
- The various other header file used are LiquidCrystal_I2C.h and nRF24L01.h which were used for the LCD display and the nRF24L01 trans receiver.
- The LCD also plays a crucial role as the data collected from the receiver.

TinyGPS++ isa new Arduino library for using and sending NMEA information streams provided by GPS modules.

- However, TinyGPS++'s software engineer interface is significantly easier to use to use than TinyGPS.

The block Diagram for transmitter side:

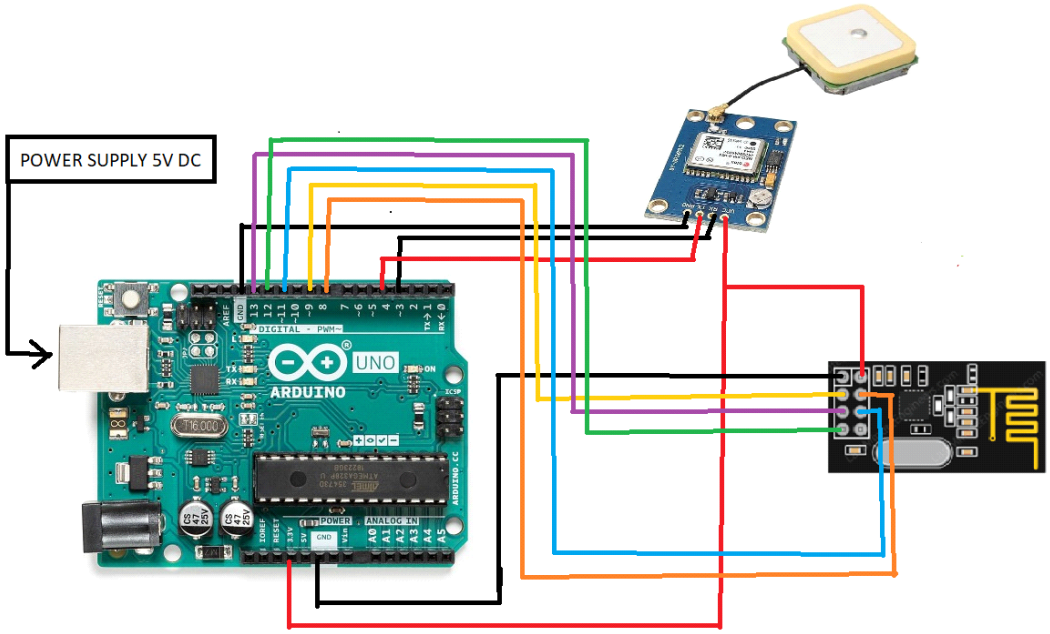

Fig4.2: The block Diagram for transmitter side:

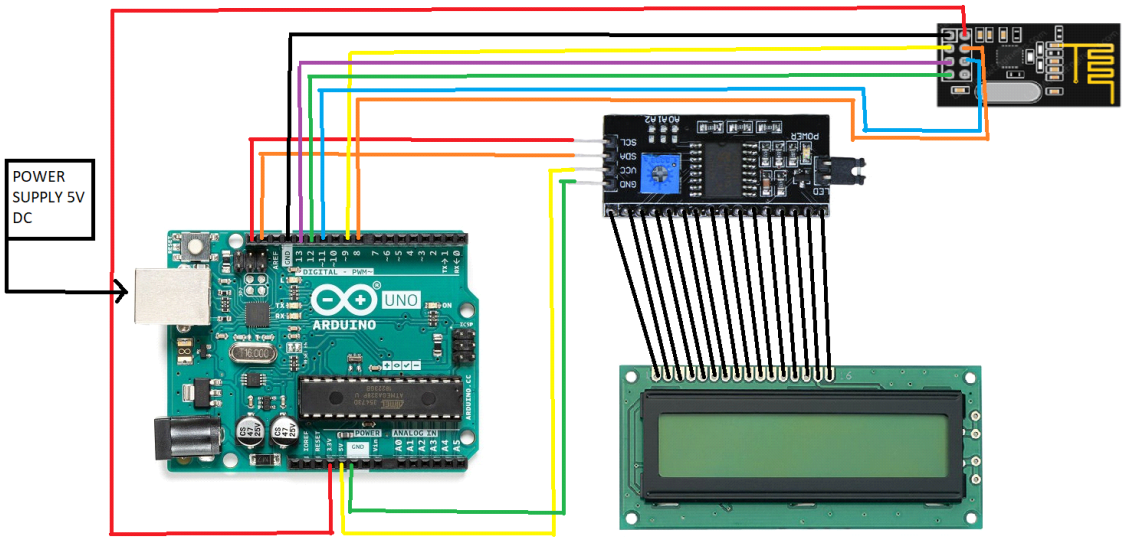

Fig 4.3 The block diagram for Receiver side

Photograph of Transmitter and Reciever

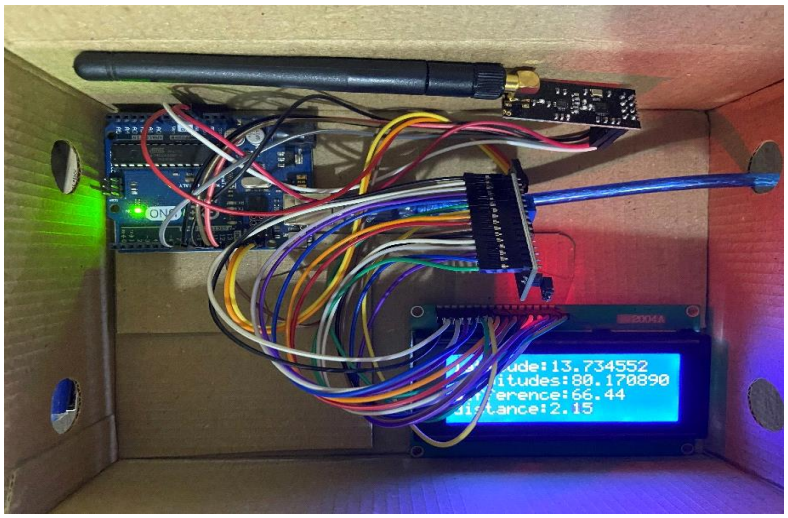

Fig 4.4 The Receiver Side

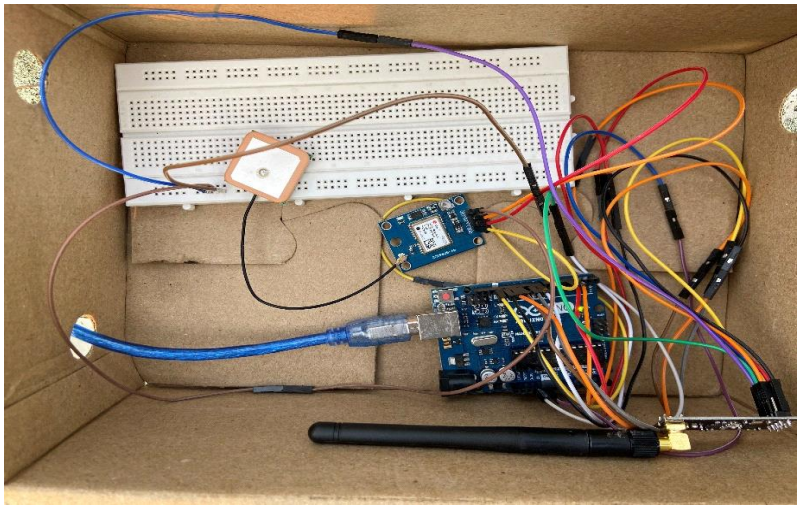

Fig 4.5 The transmitter Side

Fig 4.6 the transmitter and the receiver module

4.4 DETERMINING THE I2C ADDRESS

The I2C deal with of your LCD relies upon at the manufacturer. If your LCD has a PCF8574 chip from Texas Instruments, its default I2C deal with is 0x27Hex. If your LCD has a PCF8574 chip from NXP semiconductors, its default I2C deal with is 0x3FHex.

```
#include <Wire.h>
void setup() {
  Serial.begin (9600);
  while (!Serial)
    {
    }
 Serial.println();
  Serial.println ("I2C Scanning ...");
  byte count = 0;
 tooWire.begin();
  for (byte i = 8; i < 120; i++)
  {
    Wire.beginTransmission (i);
if (Wire.endTransmission () == 0)
  {
  Serial.print ("Found address: ");
  Serial.print (i, DEC);
  Serial.print (" (0x");
  Serial.print (i, HEX);
  Serial.println (")");
  count++;
  delay (1);  // maybe unneeded?
  } // end of good response
} // end of for loop
Serial.println ("Done.");
Serial.print ("Found ");
```

```
  Serial.println ("Done.");

  Serial.print ("Found ");

  Serial.print (count, DEC);

  Serial.println (" device(s).");

} // end of setup

void loop() {}
```

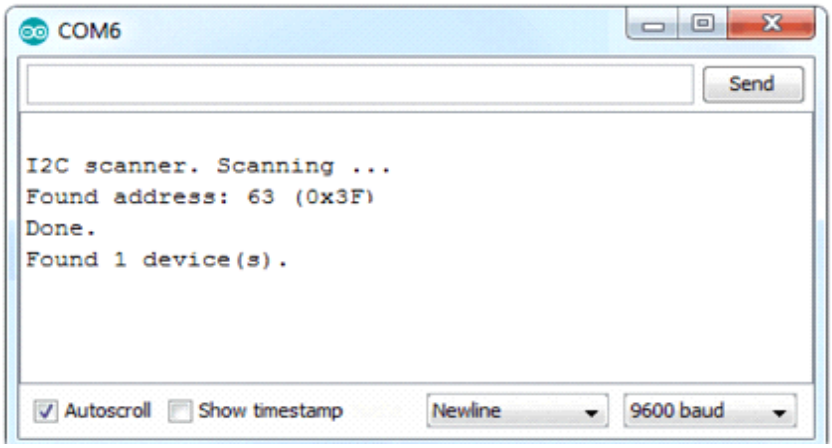

Fig 4.7 I2C output

CHAPTER 5

CODING, TESTING

The code which is written in C language is as follows:

The code for transmitter side

```
}


void loop() {
  while (ss.available() > 0){
    if (gps.encode(ss.read())){
      getInfo();
      radio.write(&gpsData, sizeof(gpsData));
    }
  }
}


void getInfo(){
  if (gps.location.isValid()){
    gpsData.longitude = gps.location.lng();
    gpsData.latitude = gps.location.lat();
  }
```

```
}gpsData;


void setup() {
  Serial.begin(115200);
  ss.begin(9600);

  Serial.println("Setting up radio");
  //  Setup transmitter radio
  radio.begin();
  radio.openWritingPipe(0xF0F0F0F0E1LL);
  radio.setChannel(0x76);
  radio.setPALevel(RF24_PA_MAX);
  radio.setDataRate(RF24_250KBPS);
  radio.stopListening();
  radio.enableDynamicPayloads();
  radio.powerUp();
  Serial.println("Starting to send");
}

      }


      void loop() {
        while (ss.available() > 0){
          if (gps.encode(ss.read())){
            getInfo();
            radio.write(&gpsData, sizeof(gpsData));
          }
        }
      }


      void getInfo(){
        if (gps.location.isValid()){
          gpsData.longitude = gps.location.lng();
          gpsData.latitude = gps.location.lat();
        }
```

```
else{
  gpsData.longitude = 0.0;
  gpsData.latitude = 0.0;
}
if (gps.speed.isValid()){
  gpsData.speed = gps.speed.kmph();
}
else{
  gpsData.speed=0;
}
if (gps.date.isValid()){
  strcpy(gpsData.date, "SHIJIN");
}
else{
  strcpy(gpsData.date,"0");
}
if (gps.time.isValid()){
  strcpy(gpsData.time, "SRM IST");
  }
  else{
    strcpy(gpsData.time, "0");
  }

}
```

The code for Receiver section :

```
#include <SPI.h>
#include <nRF24L01.h>
#include <RF24.h>
#include <LiquidCrystal_I2C.h>
#include <math.h>

// initialize the library by associating any needed LCD
interface pin
// with the arduino pin number it is connected to
LiquidCrystal_I2C lcd(0x3F,16,4);
double latitude2 = 13.734564;
double longitude2 = 80.170875;
boolean start_it = true;        //global variable

RF24 radio(9, 8); // CE, CSN

struct dataStruct{
  double latitude;
```

```
  double longitude;
  double speed;
  char date[16];
  char time[16];
}gpsData;
double haversine(double lat1, double lon1, double lat2,
double lon2) {
    const double rEarth = 6371000.0; // in meters
    double x = pow( sin( ((lat2 - lat1)*M_PI/180.0) / 2.0),
2.0 );
    double y = cos(lat1*M_PI/180.0) * cos(lat2
*M_PI/180.0);
    double z = pow( sin( ((lon2 - lon1)*M_PI/180.0) / 2.0),
2.0 );
    double a = x + y * z;
    double c = 2.0 * atan2(sqrt(a), sqrt(1.0-a));
    double d = rEarth * c;
    // Serial.printlnf("%12.9f, %12.9f, %12.9f, %12.9f, %
```

```
12.9f, %12.9f", x, y, z, a, c, d);
  return d; // in meters
}
void setup() {
 Serial.begin(115200);
 // Setup receiver radio
 radio.begin();
 radio.openReadingPipe(1, 0xF0F0F0F0E1LL);
 radio.setChannel(0x76);
 radio.setPALevel(RF24_PA_MAX);
 radio.setDataRate(RF24_250KBPS);
 radio.startListening();
 radio.enableDynamicPayloads();
 radio.powerUp();
 lcd.init();
 lcd.clear();
 lcd.backlight();
}
```

```
void loop() {
  radio.read(&gpsData, sizeof(gpsData));
  double latitude1= gpsData.latitude;
  double longitude1=gpsData.longitude;
  double distance=haversine(latitude1, longitude1, latitude2,
longitude2);
  double speed1= gpsData.speed;
  if(radio.available()){
   if(speed1 <= 1 && distance <= 1){
    lcd.clear();
    start_it= false;
   }
  else if(start_it == true){
   lcd.setCursor(0,0);
   lcd.print("DRIVER:");
   lcd.print(gpsData.date);
   lcd.setCursor(0, 1);
   lcd. print("DESTINATION:");
  lcd.print(gpsData.time);
  lcd.setCursor(0,2);
  lcd.print("Speed km/h:");
  lcd.print(gpsData.speed);
  lcd.setCursor(0,3);
  lcd.print("distance:");
  lcd.print(haversine(latitude1, longitude1, latitude2,
longitude2));
}
  }
}
```

CHAPTER 6

RESULT AND DISCUSSION

Fig 6.1 Output of Display

Our project was successfully tested for various type of environment and it was giving correct result with and error of ±1 meter when the targe was in motion

The gps turn on time:

When cloudy weather it takes at least of 10 min before we get any signal from the gps. When open sky is considered, this time was reduced to 1 to 5 min.

The transmission latency:

There was no noticeable transmission latency which was observed in the transmitter while taking data from GPS module and it was transmitting instantaneously to the receiver. There was some lag while transmitting from transmitter to receiver but it was negligible hence can be ignored.

Some other important observations:

The distance was monitored in real along with the speed and information about the bus as well the. The range of the distance was measured to be 800–1000-meter line of sight with an error of ± 1 meters only.

The RF transmission was hindered by large object such as large trucks and sometime smog. But because of the EPROM which was present in the GPS module itself which is helpful to

save the data for temporary bases and when the connecting was re-established instead of starting from the beginning it starts from where it has left.

At the time when the transmission was interrupted the display showed the lastly received data until the connection is re-established.

The speed was calculated was present in the GPS module itself and was then transmitter through air to the receiver to be showed on the display. The speed calculation delay was very less and can be neglected.

The detail of the transport in this case the bus destination to which it has to go is also transmitter along with the other data which was transmitted i.e. the distance and velocity. The receiver was able to identify multiple transmitters hence it was convenient for us as we were able to display multiple bus detail at the same time.

When the bus reached bus stop the receiver was able to detect the arrival and lcd screen was cleared and was in standby mode.

CHAPTER-7

CONCLUSION

With the help of this project, we were able to work on improving local transport system and just like the railway station we were able to make the bus stop a little more interactive and used friendly. A lot of work was done in the project yet there is scope for more as when considering the actual circumstance for this system to run smoothly a proper back-end system for monitoring is required. The system can further be improved if all the bus stops can interact with each other using various new concepts such as internet of thing(IoT) and artificial intelligence. Further this circuit can be made advance by adding time and interconnecting bus which follow same route will help other bus to change its route if one bus is stuck in traffic which will make road transportation easy to use , saving time of passenger and even cause less harm to environment as studies tell that vehicle stuck in traffic cause more pollution than moving vehicle. No doubt this will be a very costly state of affairs but it will make our day today life more convenient. With this said I would like to conclude this review on the topic distance monitoring and data transfer through radio frequency communication and gps module.

CHAPTER-8

FUTURE ADVANCEMENT

- Time can be added to display to make it more convenient
- Bus following same route or which will coincide in a route can be interlinked so that if a bus is stuck in a route other bus driver will be able to decide whether to follow same route or opt for another route
- An application can be made which will tell about status of a bus following a route
- Grievance redressal platform can be made where passenger can give their valuable experience so that system can be made better in future
- Interlinking of bus will also help if situation arise where a bus is Break-Down then another bus can go take passenger of that Break-Down bus which will be great help to passenger
- We can connect a back-end data base so that the bus-stop can share their data wire less with each other. This can further be enhanced using various new concepts such as internet of thing and artificial intelligence.

CHAPTER-9

REFERENCES

1. M.Malik, RF based wireless data transmission between two FPGAs, *IEEE Communications Surveys & Tutorials.*
2. Dinesh Suresh Bhadane,PritamB.Bharati, Sanjeev A.Shukla, MonaliD.Wani, KishorK.Ambekar A Review on GSM and GPS Based Vehicle Tracking System, *IEEE Photonics Technology Letters*
3. Vivek Kumar Pandey, Sparsh Kumar, Vimal Kumar, Pankaj Goel, A Review Paper on I2C Communication Protocol, *IJTSRD*
4. Ni Ni San Hlaing, Ma Naing, San San Naing, GPS and GSM Based Vehicle Tracking System, *IJTSRD*
5. Noppadol, Chadil Apirak, Russameesawang Phongsa, Keeratiwintakorn, Real-time tracking management system using GPS, GPRS and Google earth, *IEEE Journal on Selected Areas in Communications*
6. Ashutosh Upadhaya,Samir Bothra, Rashmi Singh, Shivanshu Gupta, Tracking System Using Gsm, Gps & Arm7, *IJTSRD*
7. Dr. Sagar Patel1, Prachi Talati2, Saniya Gandhi, RF Transceiver concepts for reconfigurable and multi Design of I2C Protocol, *IJTIMES*
8. S. Lee, G. Tewolde, And J. Kwon, World Forum On Internet of Things (WF-IoT 2014), *IEEE Communications Magazine*
9. S. Sankarananrayanan and P. Hamilton, Proceedings of 2nd Int. Conf. on Information and Communication Tech. (ICoICT 2014). (IEEE, 2014), *IEEE Communications Magazine*
10. Seung-Woo Lee, Intelligent Liquid Crystal Display (i-LCD) for Next Generation Television Applications, *IEEE Communications Magazine*
11. K. Sujatha, P. V. Nageswara Rao, and K. J. Sruthi, Proceedings of 1st Int. Conf. on Networks and Soft Computing (ICNSC 2014, *IEEE Photonics Journal*
12. Mihai A.T. Sanduleanu Maja Vidojkovic, Standard radio, *IEEE Photonics Journal*
13. M.Malik,RF based wireless data transmission between two FPGAs, *IEEE Photonics Journal*

14. i San Hlaing, Ma Naing, San San Naing, GPS and GSM Based Vehicle Tracking Syste, *IJTSRD*

15. Noppadol, Chadil Apirak, Russameesawang Phongsa, Keeratiwintakorn, Real-time tracking management system using GPS, GPRS and Google earth, *IEEE Photonics Journal*

16. Vivek Kumar Pandey, Sparsh Kumar, Vimal Kumar, Pankaj Goel ,A Review Paper on I2C Communication Protocol, *IJTSRD*

17. Seung-Woo Lee, Member, Intelligent Liquid Crystal Display (i-LCD) for Next Generation Television Applications, *IEEE Photonics Journal*

18. Dr. Sagar Patel1, Prachi Talati2, Saniya Gandhi, RF Transceiver concepts for reconfigurable and multi Design of I2C Protocol, *IJTIMES*

19. Dinesh Suresh Bhadane,PritamB.Bharati, Sanjeev A.Shukla, MonaliD.Wani, KishorK.Ambekar, A Review on GSM and GPS Based Vehicle Tracking System, *IJTIMES journal for electronics and communcation*

20. Ashutosh Upadhaya,Samir Bothra, Rashmi Singh, Shivanshu Gupta, Tracking System Using Gsm, Gps & Arm7, *Ijtimes journal for GPS technology*

21. Süleyman Eken, Ahmet SayarA, smart Bus Tracking System based on location- aware service and QR code by "Süleyman Eken, Ahmet Sayar , *Ijtimes*

22. ManiniKumbhar, MeghanaSurvase, Pratibha MAvdhutSalunk Real Time Web Based Bus Tracking System, *Ijtimes journal for communcation*

23. Yusuf Abdullahi Badamas, RFID bus ticketing , Ijtimes

24. Gabriel Gaspar and Pavol Tanuska Implementation of Secure Communication via the RF Module for Data Acquisition, *IEEE Communications Surveys & Tutorials.*

25. vaton, Martin, Low-cost implementation of Differential GPS using Arduino by Svaton, Martin, *IEEE Communications Surveys & Tutorials.*

26. M. A. Hannan, A. M.Mustapha, A.Hussain and H. Basri Intelligent Bus Monitoring and Management System, *IEEE Communications Surveys & Tutorials.*