Design and implementation of RFID based tracking algorithms for a moving object

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I hereby recommend that this thesis prepared by **Anibrata Ghosh** entitled "**Design and implementation of RFID based tracking algorithms for a moving object"** under my supervision be accepted for partial fulfillment of the requirements for the award of the Degree of Master of Electronics and Telecommunication Engineering.

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CERTIFICATE OF APPROVAL

The foregoing thesis**," Design and implementation of RFID based tracking algorithmsfor a moving object"**, by **Anibrata Ghosh** (Registration No. **150148 of 2019-2020** and Roll Number **M6VLS22020**) is hereby approved as a credible study of an Engineering subject carried out and presented in a manner satisfactory to warrant its acceptance as prerequisite to the Degree for which it has been submitted. It is understood that by this approval, the undersigned don't necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the thesis only for the purpose for which it is submitted.

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Examiners

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DECLARATION OF ORAGINALITY AND COMPLIANCE OF ACADEMIC ETHICS

I hereby declare that this Thesis contains literature survey and original work by the undersigned candidate, as part of his Master of Electronics and Telecommunication Engineering studies.

All information in this document have been obtained and presented in accordance with academic rules and ethical conduct.

It is also declared that, as required by these rules and conduct, I have fully cited and referenced all materials and results that are not original to this work.

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Abstract

The development of social services and enhancement of the living standards has made it an urgent need for a way to adapt to the complex situation of the new positioning technology. Also, data transmission is very important from one portable device to another. But secured data transmission is also important otherwise hacker can control the data communication. Radio Frequency Identification is the next generation wireless communication technology. RFID is a noncontact technology that identifies objects that are attached with tags. Tags consist of microchip and antenna. RFID readers obtained the information about the object and the surrounding through communication with tag antenna. In recent era, RFID technology have a wide range of applications in all aspects of life and production, such as logistics tracking, car alarm, security and other items.

The use of RFID technology is to locate and is very promising for various research and scholarly work. RFID positioning technology has

system stability, with minimum error and low-cost advantages and a location algorithm with RFID application is the focus of this study.

In this article, I have tried to design a model of RFID based tracking system to catch a dynamically moving object, more specifically the suspected hens which are affected by the Avian-influenza virus.

As a case study I have developed an algorithm for RFID based tracking system and implemented it in python scripting language and stored the data in database by using MySql. In order to collaborate my design and implement the system I have verified my proposed system using simulated environment. The results are found satisfactory.

CHAPTER 1

INTRODUCTION

1.1 Basic of RFID:

RFID or radio frequency identification is a method to automatically identify people, animals or objects by means of radio waves. A RFID device (Tag) is physically attached to the object that we want to recognize. This is known as tagging and the object is said to be tagged or marked. In case of an animal, it could be an injectable tag and in case of human, it may take form of an wrist band that the person wears or as an ID card.

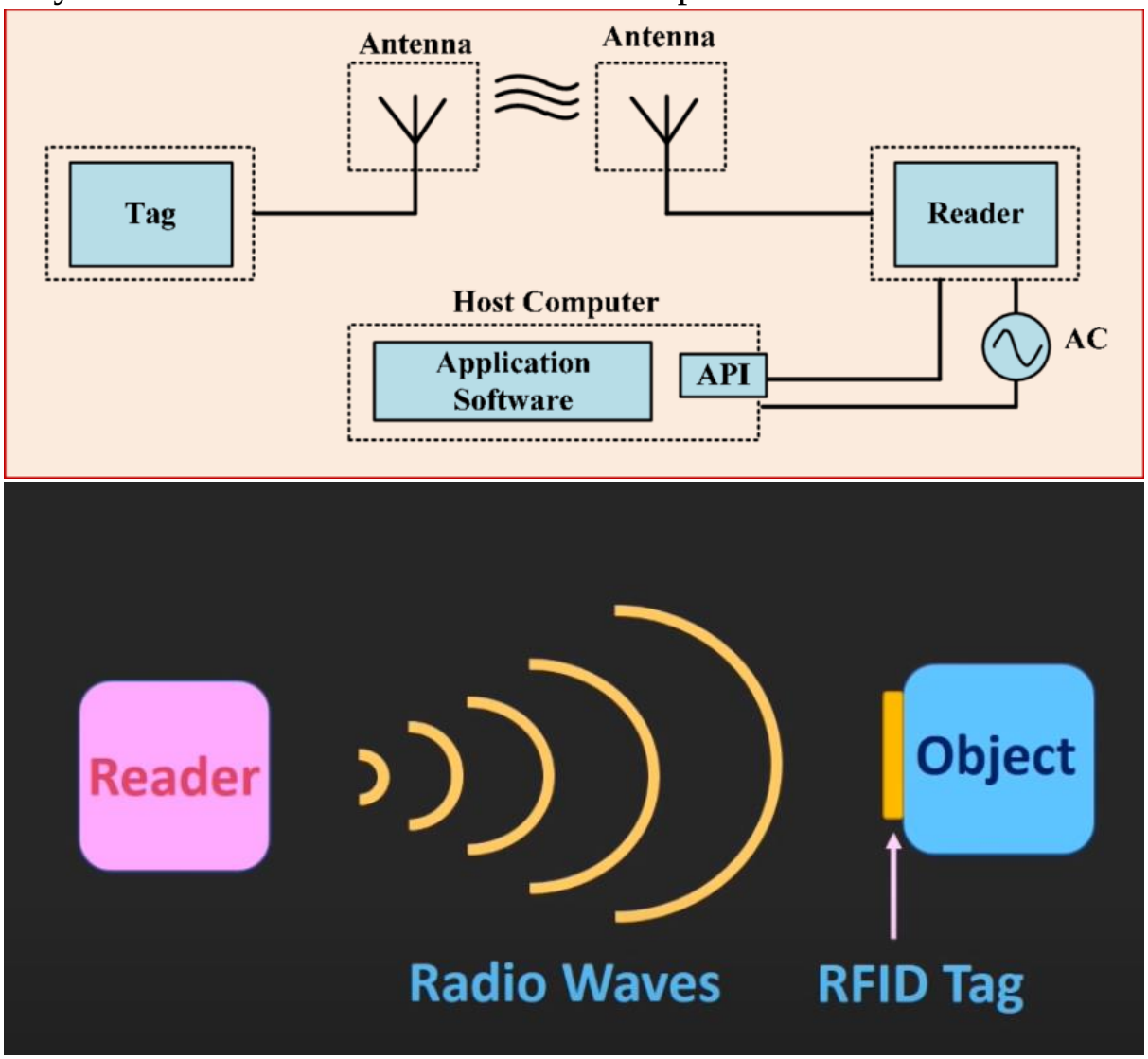


Figure 1.1. Component of RFID system

1.2 Components of RFID systems:

An RFID system is always made up of two components:

1. The transponder, which is located on the object to be identified,
2. Detector or reader, which depends upon design and the technology used, may be a read or write/read device.

A reader typically contains a high frequency module (transmitter and receiver), a control unit and coupling element to transponder. In addition, many readers are fitted with additional interface (RS232, RS485) to enable it to forward the data received to another system (PC, robot control system). The transponder, which represents the actually data carrying device of an RFID system, normally consisting of coupling element an electronic microchip. When the transponder, which does not usually possess its own voltage supply(battery), is not within the response range is totally passive. The transponders are only activated when it is within the range of reader. The power required to activate the transponders is to supplied to the transponders through the coupling unit (contactless) as is the timing pulse and data.

Types of RFID tags:

RFID tags can be distinguished into two categories depends on their data storage capability: Read-Only and Read/Write Tags. Most Read-Only tags do not have data storage capacity. They only have a unique ID prewritten to them which points to a database, thus providing information about the object the tag is attached to. RFID tags can also be distinguished as active and passive. Passive tags depend on the electromagnetic field generated by the RFID reader inn order to get activated.

Active tags have built-in batteries and this increases the range of the system as the tags do not depend on the electromagnetic field of the reader in order to get activated. The power, however, of the tags may be reduced by the actual size of the tags as well as the local radio licensing regulations.

1.3 Difference between active and passive tags:

PARAMETERS	ACTIVE RFID TAGS	PASSIVE RFID TAGS
Tag power source	Internal to tag	Energy transferred from the reader
Availability of tag power	Continuous	Only when found in the field of the reader
Required signal strength from reader to tag	Low	High
Available signal strength from	High	Low
tag to reader		
Communication range	Long range	Short range
Multi-tag collection	Scanning of thousands of tags from a single reader Scanning of up to 20 tags moving at more than 100 miles/hour	Scanning of thousands of tags within 3 meters from a single reader Scanning of up to 20 tags moving at more than 3 miles/hour or slower
Sensor capability	Ability to monitor continuously	Monitor sensor input when tag is powered from the reader
Data storage	Large	Small

1.4 Frequency of use of RFID system in different countries:

Frequency	Countries
125-134 kHz	USA, Canada, Japan, Europe
13.56 MHz	USA, Canada, Japan, Europe
433.05-434.79 MHz	In most of USA and Europe and under consideration Japan
865-868 MHz	Europe
866-869 and 923-925 MHz	South Korea
902-928MHz	USA
952-954 MHz	Japan (for passive tags after 2005)
2400-2500 and 5.725-5.875 GHz	USA, Canada, Japan, Europe

The frequencies used in RFID systems are analyzed below:

- 1235-134 kHz: This is the low frequency which allows the detection of RFID tags in arrange of less than 0.5m. The typical data transfer rate is less than 1 kbit per second and in this frequency the electromagnetic waves penetrated water but not metal. This frequency is used for animal identification.
- 13.56 MHz: This frequency allows the detection of RFID tags for a distance of up to 1.5m. The data transfer rate for this specific frequency is approximately 25kbits per seconds and in this frequency, the electromagnetic waves can penetrate water bot not metal. The frequency is used for application related to access and security.
- 433-956 MHz: The frequencies which belong to this range are characterized as ultra-high frequencies. The frequencies at the range from 433 to 864 allow the detection of RFID tags for a distance of up to 100m while the frequencies at the range 865 to 956MHz allow the detection of RFID tags for a distance which varies from 0.5 to 5m. For all frequencies in range between 433 to 956 MHz, the data transfer rate is 100 kbits per second. The generated electromagnetic waves cannot penetrate water or

metals. The frequencies at this range are used for application in logistics.

- 2.45 GHz: This frequency enables an RFID reader to detect a tag from a distance of ten meters. This specific frequency is characterized as microwave frequency. The data transfer rate for this specific frequency is up to 100 kbits per seconds. The electromagnetic waves generated in this case cannot penetrate water or metal. The specific frequency is used for application related to mobile vehicle toll.

  The US Federal Communication Commission (FCC) has located spectrum in the 5.9GHz band. Table of frequency uses summarized the frequencies of use of RFID-systems for a number of countries. There have been many attempts to harmonize the frequencies of use of RFID internationally. The Federal Communication Commission (FCC) has modified its rules for the use of RFID in order to harmonized with the European Telecommunication Standards Institute (ETSI). The band 13.553-13.567 MHz is used for Industrial, Scientific and Medical (ISM) application. The FCC has also increased the level of power and bandwidth so RFID could be used under the limits developed by ETSI. 13.410MHz was 20dB and there is also operation in bands where no radiation was allowed.

1.5 Recent trends in RFID:

RFID application in the business word is numerous. An XML database consultant might recommend a variety of integrated systems to improve a company's profitable and efficiency. Here are some of the benefits the technology can provide.

More Accurate Inventories:

Regardless of what business you are in, RFID-tags can be used to make inventorying items easier, faster and more accurate. In the future, the tags are expected to replace barcodes, because they are more sensitive and can be read from longer distance.

Increase Safety:

In the medical communication, the tags are providing increased patient safety. Pharmacies are better able to keep track of drugs and prevent them from falling into the wrong hands. Surgical procedures are safer when sponges and other small items are tagged. The number present before and after the procedure is done can be easily calculated. The likelihood of sponge being left in a patient, the most common accident, is greatly reduced.

Increase Security:

In companies where security matters most, tracking employee movement, the opening and closing of doors, the movement of assets and other changes in the building is becoming easier for security specialists. Cameras can fail or be overridden by smart thieves. With the right RFID application and software programs, cameras are practically obsolete.

Easier Payment Collection:

An XML database consultant might recommend an automated payment collection system for delivery drivers or service providers. Payment can be made and accepted using mobile phones and tags that function as credits card readers. This reduces the paperwork required for billing

and number of employees needs to do the billing. It also reduces the risk of bad debt.

Increased Efficiency in Shipping Yards:

An XML database consultant would be familiar with all of the shipping and freight distribution companies that are making use of the latest RFID applications. Business owns are happy with the results because of improvement efficiency and less loss.

Increase Profitability:

All of the benefits add up to one thing, regardless of the types of business. That is increased profitability. In all cases, the systems should be tailored to fit the specific needs of the business. That's where, XML database consultant and designer

come in. Practically all office application makes use of XML code. Programing the code to work with the tags and readers is something best left up to the professional. Your company's data storage requirements are among the things that designers would take into consideration. They can also provide more information about the latest RFID application.

1.6 Application of RFID systems:

RFID technology has been successfully applied in a number of scientific and technical fields, such as medicine and engineering. In medicine, RFID tagging is used in blood transfusion and analysis. An RFID tag can be attached o a wristband which contains information about a specific patient. A wireless reader communication with the tag and the information which is contained in the tag appears on the screen of the mobile device of the consultant. An RFID reader scans the tags which are attached to blood bags and finds the appropriate blood bags for the specific patents. RFID technology has also been applied in the aeronautics industry supply chain. Specifically, Boeing ships tagged crates which are loaded with aeronautical equipment. Passive electronic products code class 0 RFID tags are attached to these crates and they contain information such as unique ID number which can be read by RFID reads at a depot. Boeing then sends an advance report to the depot regarding the contents of the tag. This information is a list of the crate's contents, the quantity, the point of origin, and the purchase contract. A Boeing worker manually enters the information into the wide area workflow (WAWF) system. When the loaded crates are delivered attached to the creates. These number point to a database which information include on the advance shipment report send by Boeing. An important element in the construction and maintenance of oil facilities is the correct assembly of the pipe work systems with the correct gasket, bolts and to the correct torque. An incorrect assembly would create leaks which can affect safety in an oil refinery. RFID tags can be used in order to identified individual pipe-work and process equipment. RFID tags can be embedded in the valves of the pipelines and record technical information. An RFID reader can be used to scan these tags and identify whether a valve is the correct one, in the correct location and at the correct pressure. In addition, RFID technology is used to trace the movement of fuel tankers and in the management of equipment servicing. In the automotive industry, RFID technology is used in the assembly of new cars. Specifically, RFID tags can be attached to parts of a car and track then them during the assembly

process. Since every customer in the automotive industry may have different choices as to as to how his/her car should be, the use of RFID tags allows faster tracking of the desired components and avoidance of possibly caused errors by incorrect placement of these components. In the retail industry, RFID tags are used to identify and track products along the retail supply chain. The tags can be attached to physical items, such as pens or toothpastes, and transmit an identification signal allowing them to communicate with RFID reader or with each other. An example of a consumer goods tracking system in the Auto-ID system. This system uses a numbering scheme called Electronic Product Code (EPC) which can assign a unique ID to any physical object in the world. In the retail industry, the Auto-ID can assign a unique ID to a specific product through an RFID tag and then the tag transmits this ID to an RFID reader, thus making the product identifiable.

I. DIT – Department of Information Technology:
   A project has been initiated at CDAC NOIDA and IIT KANPURE for joint development of one pilot application using RFID technology. As a part of this project, preliminary work on setting up of a state-of-the-art RFID lab in the country will be progressed with an object to make this lab as the 8th Auto ID lab in the world.
II. Department of Road Transport and Highways:
   The Ministry of Read Transport and Highways, Government of India, T.R. Baalu launched a pilot project for RFID based vehicle tracking project on the Delhi-Jaipur highway of India.
III. CRIS-Centre for Railways Information System:
   The Centre for Railway Information System of Indian Railways plans to use RFID to improve the wagon management system of the railways.
IV. Wipro's RFID solution for Manufacturing:
   Wipro's Manufacturing Solution's center of Excellence (CoE) has a dedicated teams of consultants who help customers define, analyze, design and implement RFID solution.

V. Infosys and RFID:

Infosys Technologies (NASDAQ:INFY) today announced that it has successfully implementation SAP solution for RFID for CHEP's Global Track and Trace system. CHEP, the global leader in pallet and container pooling services, expects to use this system provide real time visibility to its customers for their products as well as for tracking assets on which these products are shipped.

VI. Animal Tracking:

The Kopordem farm at Valpoi in Sattari Talluk in North Goa has become the first farm in India to use RFID micro chips that can be attached with the animal's body for proper tracking and other purposes.

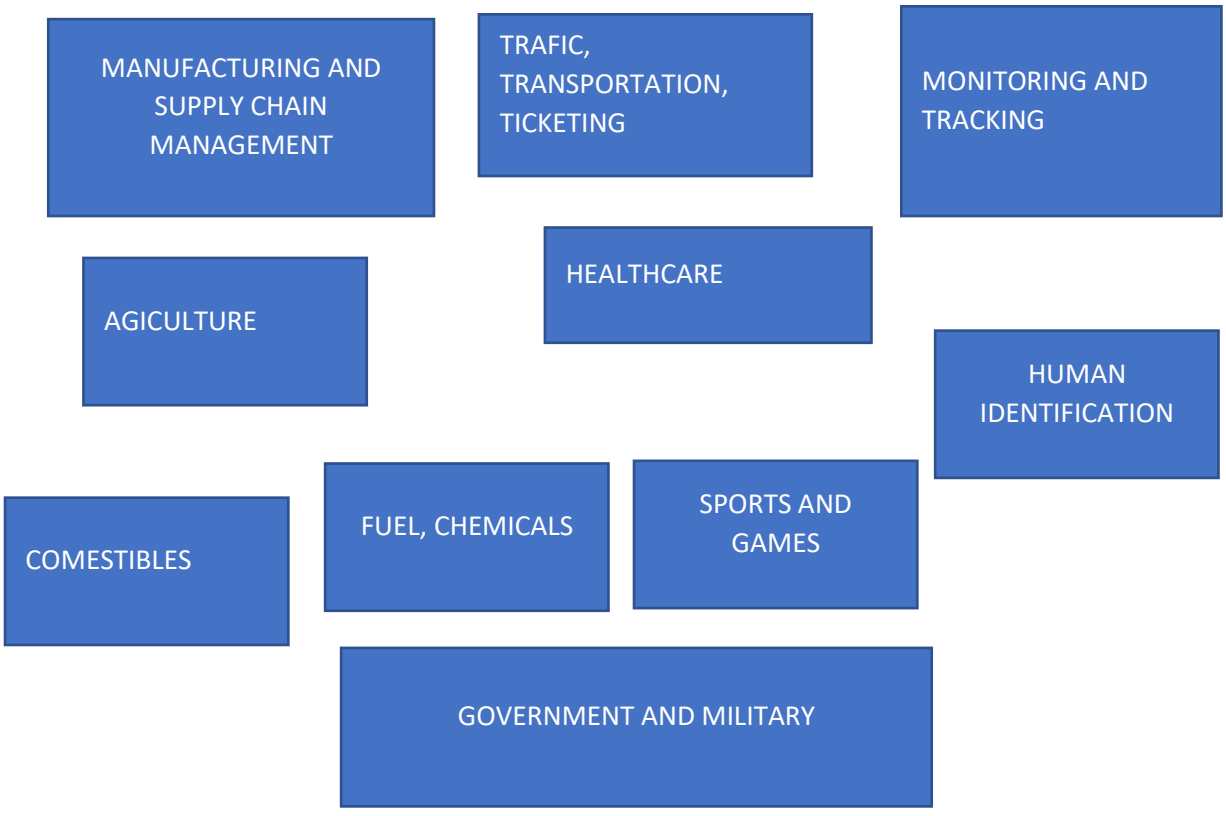


Fig 1.2: Application area of RFID

CHAPTER 2
Literature Review

There are various applications of RFID in literature. Some of them are discussed in this chapter.

2.1. In 2004, George et.al. demonstrated "An RFID Based Luggage & Passenger Tracking System for Airport Security Control Applications".

According to the author, one of the most difficult tasks in the security field is airport security. Airports are enormously crowded public spaces, making them prime targets for terrorist attacks, with planes, passengers, crew, and airport infrastructure all vulnerable. Within this maze of security issues, UHF passive RFID technology's long-range detection capacity can be turned into a critical tracking tool that can beat all of the limits of barcode tracking within the current airport security control chain. This article discusses the system's application scenarios, which are organized according to the structured nature of the environment, as well as the system architecture and assessment findings derived from measurements with a variety of GEN2 UHF RFID tags that are widely available in the market. the global market

The use of passive RFID technology for airport security controls and security logistics has numerous advantages in this area. The viability of indoor localization using RFID has been investigated. Passive RFID tags are inexpensive, and because of their small size, they can be easily attached to objects without interfering with existing security procedures, such as luggage tags, or even printed as part of them. RFID, which has already been extensively tested in the logistics industry, can quickly deliver readings from various entities and across relatively vast

areas, and the lack of a battery simplifies use case logistics and boosts the system's robustness. RFID also enables a range of novel airport uses, such as "positive baggage." boarded ", such as locating passengers and directing them to the gate in a timely manner to avoid delays, or self-boarding apps. Furthermore, RFID tagging can be used to give a reliable means of assessing the effectiveness of the security screening process, as well as to identify bottlenecks in the process and improve the overall efficiency of the boarding process logistically. The RFID Based Luggage & Passenger Tracking System was a vital aspect of the TASS multi-level surveillance and intelligence system, which integrates and fuses data from many types of real-time sensors and subsystems in the framework of the TASS project. boarded ", such as locating passengers and directing them to the gate in a timely manner to avoid delays, or self-boarding apps. Furthermore, RFID tagging can be used to give a trustworthy method of measurement. The efficiency of the security checking process can be utilized to detect bottlenecks in the process and, as a result, the overall boarding process logistics can be improved. The RFID Based Luggage & Passenger Tracking System was a vital aspect of the TASS multi-level surveillance and intelligence system, which integrates and fuses data from many types of real-time sensors and subsystems in the framework of the TASS project.

2.2. In 2016, Zi Min et.al. demonstrated "RFID Location Algorithm"

According to the author, RFID technology has a wide range of uses in all sectors of life and manufacturing, including logistics tracking, automobile alarms, security, and a variety of other things. In the views of numerous research organizations and researchers, the use of RFID technology to locate is a new direction. This research focuses on RFID positioning technology system stability, small error, and low-cost advantages of its location algorithm.

The layers of RFID technology targeting approaches and algorithms are examined in this article. First, many basic RFID approaches are introduced; Second, a strategy for locating political networks with greater accuracy will be described; last, the LANDMARC algorithm will be described.

In the field of RFID positioning technology, now commonly used positioning divided into three areas, namely:

(1) To reach the positioning information,

(2) Positioning signal strength,

(3) Measuring the azimuth positioning.

It can be observed from this those innovative and efficient algorithms play a significant role in improving RFID positioning accuracy. Finally, the algorithm is implemented. Finally, the RFID location technology algorithm is summarized, highlighting flaws in the algorithm and proposing follow-up research of the needs, as well as a vision for a better future RFID positioning technology.

2.3 In 2016, Qiushi et.al. demonstrated "Research and Implementation of an RFID Object Tracking System Simulation Platform "

According to the author, For its useful application in space-time information query, radio frequency identification (RFID) has been the focus of research. Due to the difficulty of conducting experiments in real RFID application systems, this work presents an RFID object tracking system simulation platform to aid in the study of RFID uncertain data management and space-time information query. This work proposes a simulation technique that combines discrete event scheduling and activity scanning after investigating simulation models of the reader, tag, and radio propagation in the physical and logical layers. Three layers based on Eclipse RCP and GEF implement the platform. The system can simply be expanded by adding a new plug-in created by the user. Finally, a simple object tracking test is performed to demonstrate. Finally, a rudimentary object tracking test is shown to demonstrate that it can accurately mimic RFID application scenes and can aid research in this sector.

Entities, characteristics, and activities are all part of a simulation system.

There are three essential components. The objects that make up the system are known as entities. Readers, tags, radio propagation techniques, environment features, inner processing units, and other entities are included in this system. These elements are not only self-contained, but they can also be combined to form a whole. A property

is a description of an entity's characteristics that is conveyed by a parameter or variable. A reader's attributes, for example, include transmit power, working frequency, cache volume, capture ratio, and so on. An activity is a process that an entity does over a period of time, such as a reader transmitting data packages, a data package being wirelessly transferred, a tag receiving and backscattering data packages, and so on. To elucidate the RFID's nature, He provides a non-form description of the RFID system model for our simulation system. This article creates and builds a single-machine RFID object tracking system simulation platform. The platform's key contribution is its elegant architecture and high extensibility. It has been demonstrated through testing that it can help with RFID uncertain data management and space-time information query research.

2.4. In 2017, Gaurav et.al. demonstrated "RFID based Tracking System"

According to the author, RFID (Radio Frequency Identification) is on its way, and it'll bring a streamlined revolution with it. When it comes to tracking devices, Radio Frequency Identification (RFID) is the most recent development in decades that can be utilized as an effective tracker. The invention of a tracking system based on Radio Frequency Identification (RFID) technology is relatively new, but it has a lot of potential. This system employs RFID technology to track employees' official assets as they enter and exit the building (E.g. laptops). The Tracking System is based on an external database system that will offer the reader's recorded information. Because the database has detected

the reader, the tracking system will process the data and display the subject tracking results. In the corporate world, RFID tracking has exploded in popularity. One of the main problems is its movement in and out of the office on a daily basis. This makes Instruments vulnerable to theft, resulting in the loss of not only an asset but also valuable and sensitive data. It is critical for the business to guarantee that the correct laptop is brought into and out of the facility. This system employs RFID technology to track employees' official laptops' entry and exit (devices). The goal of this solution is to shorten long lines at corporate gates by limiting manual checks to visitors and staff using prohibited laptops. Each employee will be stored in the company's master HR database. Employee id card (RFID-based I Card) with laptop tag (RFID based tag adhered to the laptop). If an employee enters or exits the corporate gates with an approved laptop, the manual inspections can be skipped, saving both time and money.

2.5. In 2013, Tanvir et.al. demonstrated "RFID based Tracking System"

According to the author, Baggage handling at airports is far from perfect. Baggage gets on the wrong flight, is left behind, or is lost, which costs the airlines money and causes passengers frustration. To address the situation, we present a data warehouse (DW) solution for storing and analyzing spatiotemporal RFID baggage tracking data. Analysis of this data can yield interesting results on baggage flow, the causes of baggage mishandling, and the parties responsible for the

mishandling (airline, airport, handler,...), leading to improved baggage handling quality.

The paper describes a well-designed data warehouse (DW) with a relational schema sitting beneath a multidimensional data cube that can handle the data's many complexities. The paper also goes over the Extract-Transform-Load (ETL) flow, which is responsible for loading the data warehouse with the appropriate tracking data from the data sources. The concepts presented here can be applied to other types of multi-site indoor tracking systems based on Bluetooth and RFID. A large amount of real-world RFID-based baggage tracking data from a major industry initiative was used to test the system. The developed solution reveals interesting insights while also being several orders of magnitude faster than computing the results directly on the data sources. A multidimensional database warehouse solution for RFID-based baggage monitoring data is presented in this research. To our knowledge, this is the first study to design a multidimensional data warehouse for this significant area, incorporating a relational DW schema with a data cube on top. The suggested data warehouse aids the airline baggage handling process by providing a framework for data analysis and complicated query responses, which can help to improve baggage handling quality.

2.6 In 2014, Jianqiang Wang et al. A paper titled "RFID-Based Vehicle Positioning and Its Applications in Connected Vehicles". To facilitate connected car applications, this article developed an RFID-based vehicle location solution. In connected car applications where GPS is unavailable or of insufficient quality, this study suggests an RFID technique as a useful alternative to locating. Estimation must be conducted based on the most recent location update from tags to fill gaps between tags. To confirm the RFID-based positioning approach, road tests are conducted. Onboard radar and an RFID reader are used in one type of experiment. The radar is utilized to provide the test vehicle's "actual" positions, which are compared to estimates using RFID-based positioning. The result reveals an excellent match between the two vehicle position sources. The other sort of experiment looks to see if the estimated position from the kinematics integration matches the position determined by the tags. The assessment of vehicle position is triggered by a photoelectric switch depending on the most recent tag update. The results show that during acceleration or deceleration, the position inaccuracy is roughly 5.4 percent, and around 2.5 percent when the speed is rather stable.

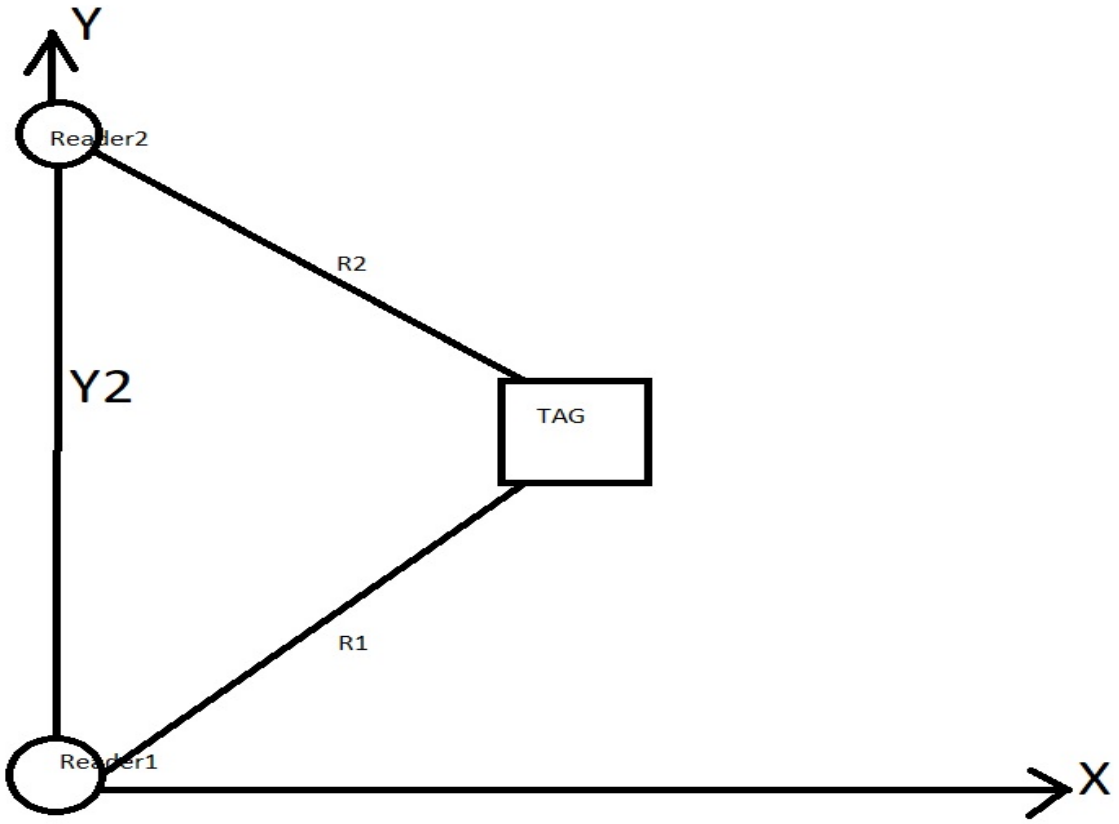
2.7 In 2015, Enrique et.al. demonstrated "Evolution of RFID Applications in Construction a Literature Review". They suggested using RFID as a locating alternative in connected car applications if GPS is unavailable or of poor quality. RFID tags are placed on the road surface, and automobiles have on-board tag scanners. When a reader passes over a tag, the position information recorded in the tag can be read. RFID allows for the control of a wide range of processes at various stages of a building's lifecycle, from conception to occupancy.

Chapter 3

Software modelling and simulation

3.1Software simulation modelling for tracking:

For the tracking of an object one tag is docketed with that object. Placing the reader in horizontal direction and doing the calculation for above. The model is generated by using python and the data put in the data base by using MySql quarry. For developing that model I have to import the library like random, cmath, numpy, matlib, mysql.connetor,



time and datetime. Here I use the matlib library for plotting the graph.

Fig4: Placement of the reader on the axis

For fetch the time I import the library time and timedate. To store the data into the database for this reason I have to import the mysql.connector.

3.2 Calculation for finding the location:

To identify the moving object, it is tagged and release in cage, the readers are placed horizontally in one of the walls(axis) of the cage.

Taking the coordinate of the reader1 is (x1, y1) and the coordinate of the reader2 as (x2, y2) and the co-ordinate of the tag is (x0, y0). I have to find the value of the x0 and y0 by the from the following calculation.

The value of R1 and R2 can be found from the reader ("here I do the software simulation so, I use the 'random library' to generate the value of the R1 and R2 with the range 1 to 12 meter) . Here I placed the reader on the same line so the here I consider X1=X2=0 and the Y0=0 and Y2=12

When we consider Reader 1 and the co-ordinate (x0, y0)

$$(x_1 - x_0)^2 + (y_1 - y_0)^2 = {R_1}^2$$

$${x_1}^2 + {x_0}^2 - 2x_1x_0 + {y_1}^2 + {y_o}^2 - 2y_1y_0 = {R_1}^2$$

$${x_0}^2 + {y_o}^2 - 2x_1x_0 - 2y_1y_0 = {R_1}^2 - ({x_1}^2 + {y_1}^2)$$ **..... (i)**

When we consider Reader 2 and the co-ordinate (x0, y0)

$$(x_2 - x_0)^2 + (y_2 - y_0)^2 = {R_2}^2$$

$${x_2}^2 + {x_0}^2 - 2x_2x_0 + {y_2}^2 + {y_o}^2 - 2y_2y_0 = {R_2}^2$$

$${x_0}^2 + {y_o}^2 - 2x_2x_0 - 2y_2y_0 = {R_2}^2 - ({x_2}^2 + {y_2}^2)$$ **..... (ii)**

We get the final result as … (i)-(ii)

$$2x_2x_0 - 2x_1x_0 + 2y_2y_0 - 2y_1y_0 = {R_1}^2 - ({x_1}^2 + {y_1}^2) - {R_2}^2 + ({x_2}^2 + {y_2}^2)$$

$$\boldsymbol{2x_0(x_2 - x_1) + 2y_0(y_2 - y_1) = ({R_1}^2 - {R_2}^2) - ({x_1}^2 + {y_1}^2) + ({x_2}^2 + {y_2}^2)}$$

Considering x_2 *and* x_1 are same, we get

$$\boldsymbol{y_0 = \frac{({R_1}^2 - {R_2}^2) + ({x_2}^2 + {y_2}^2) - ({x_1}^2 + {y_1}^2)}{2(y_2 - y_1)}}$$

By putting the value of y_0 at equation (i) we get the value of x_0

$$\boldsymbol{x_0 = \sqrt{\frac{{R_1}^2 - ({x_1}^2 + {y_1}^2) + 2y_1y_0 \ - {y_o}^2}{(1 - \ 2x_1)}}}$$

3.3 Flow chart:

In this part of this chapter, I have discus the flowchart of the of the tracking algorithm. The program starts with the object id there is a condition arises if the object id in the list, then only farther proceed of the program otherwise there should be the termination and a massage will be generated. After putting the correct object id reader detect the object to be found and then the distance will be measure accordingly and put it into a list after the calculation will make accordingly and then with that value the graph is plotted accordingly and the also find the location of the object the user want. After that the date is inserted into the database and by using the data base, we can also show the data.

Flow chart for tracking algorithm:

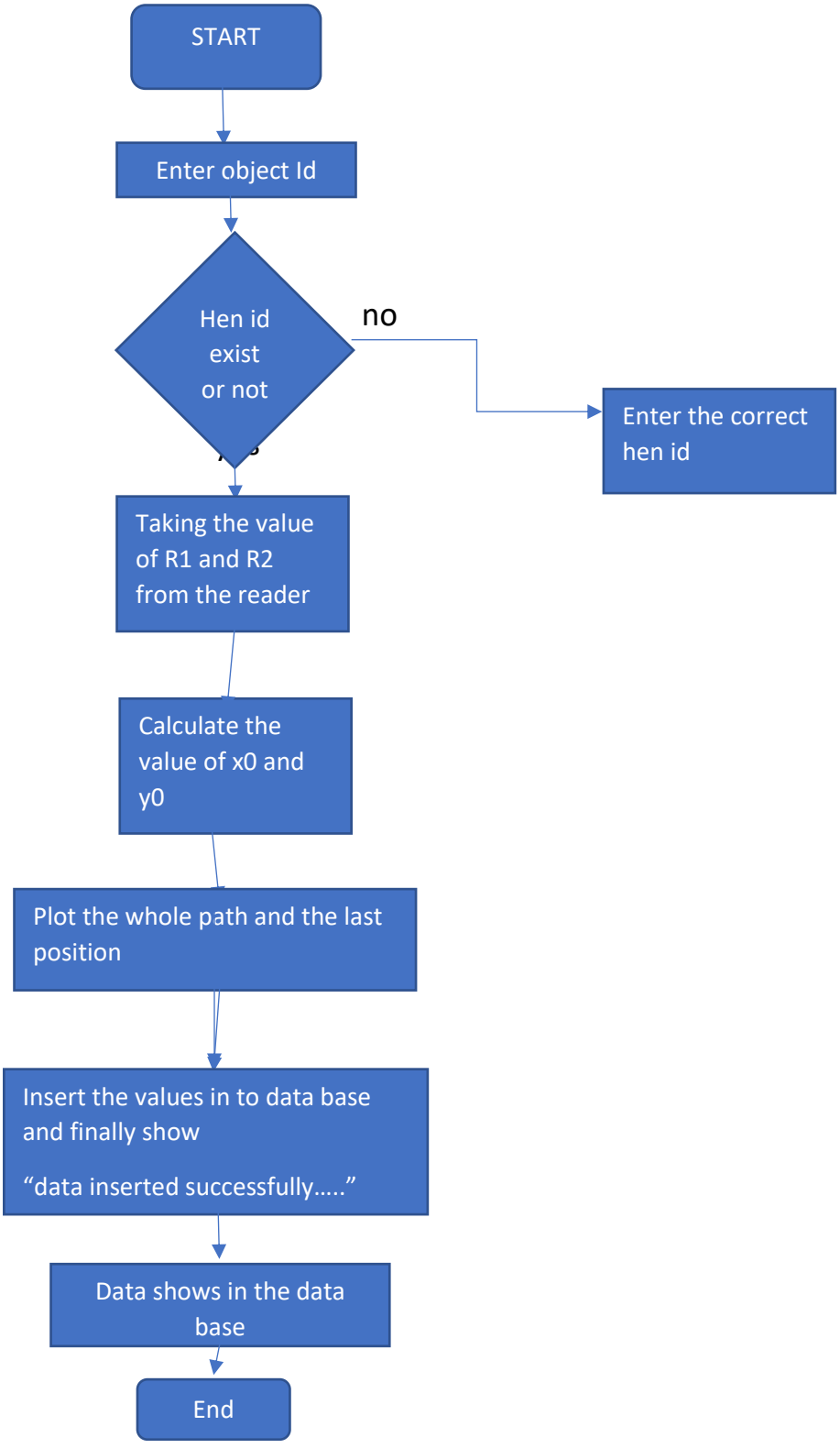


Fig5: Flow chart for the tracking algorithm

3.4 Algorithm:

Algorithm formation steps:

1. First enter the correct id of the correct object id.
2. Fetching the distance of the tag from the reader1 and reader2.
3. Do the calculation.
4. Plot the path of the moving object.
5. Plot the any position of the object at any instant.
6. Put the value in the database.
7. Using MySql query all data can be shown in the database.

Algorithm and escudo-code of tracking algorithm:

Step1: set x1=0,y1=0,x2=x1,a=1 and a1=12

Step2: take input for y2 by the user

Step3: take the henid

Step4: square the value of y2

Step5: set flag=0

Step6: if henid in henlist then

Step7: set flag=1

Step8: end if

Step9: if flag = 1 then

Step10: n=10

Step11: set r1=[] and r2=[]

Step13: for I in range(0,n) do

Step14: l=random.randint(a,a1)

Step15: r1.append(l)

Step16: end for

Step17: for I in range(0,n) do

Step18: l=random.randint(a,a1)

Step19: r2.append(l)

Step20: end for

Step21: set y0=[]

Step22: for I in range(0,n) do

Step23: k=(r2^2-r1^2+y2^2)/(2*y2)

Step24: end for

Step25: Square y0

Step26: set x0=[]

Step27: for I in range(0,n) do

Step28: if r1[i]>y0[i] then

Step29: ar=(r1^2-y0^2)^0.5

Step30: x0.append(ar)

Step31: else

Step32: ar=(y0^2-r1^2)^0.5

Step34: x0.append(ar)

Step35: print the values of x0,y0,r1,r2.

Step36: plot the value in graph in x and y direction to find hole path

Step37: enter the position user want to see the chicken

Step37: insert the value in the data base

Step38: else

Step39: enter the correct hen id

Step38: end if

3.5 Expiation of escudo-code for tracking algorithm:

For developing the algorithm, I have used Python. I have imported many python library like time, datetime, random, matlib, mysql.connector ect…. . Here we take a list for taking the data, for storing the distance and then calculation is done. After the listing the data a first y0 calculation is done and then with the help of this calculation x0 is find out and then this is done for ten times for locating the object in ten different values. By using plot function (from matlib) the values are plotted in a graph and after that the user asked to enter the serial number then that can to plot the location user want to see the object. After doing all this, this is the time to insert the data into the database. This is the way the whole process works and satisfactory result comes.

Chapter 4

Result and Discussion and application

4.1 Result and discussion of the algorithm:

In this algorithm I can detect the moving object. I placed two readers in one corner in the room and the tag is tagged in the body of the object. When the object come closed to the reader read the tag the distance from the tag from the reader is fetch. After that the date inserted into the list and as many time the tag come closed to the readers the distance is fetched and the inserted into the list. The user has to enter the correct id of the moving object and after that the algo get started and the calculation is done for the value of the x0 and y0. Then by this co-ordinate I have plot the graph which shows the path in which the chicken moves. Then user, they have to enter the Serial number to find the location of the moving object at any time instant.

The graphs are show bellow figure in this chapter. Then after finishing the algo all the data inserted in the data base and I use mysql for the data handling purpose. I make data base name as Anibrata1; and create a table for insertion of the data for storing purpose and handle it for future us which is generated by the algorithm. To see the data in the database I have to use the keyword “SELECT”. In this way my whole algorithm works. I get the satisfactory output from my algorithm. The output are shows as follow.

The total path of the moving object:

This is the total path of the moving object, this path is calculated by join the values of (x0,y0) co-ordinates and plot it in to the graph. After see the whole path the user have to enter the serial number to see the instant at which the user want see the location that object. The generated graphs are shown the figure bellow.

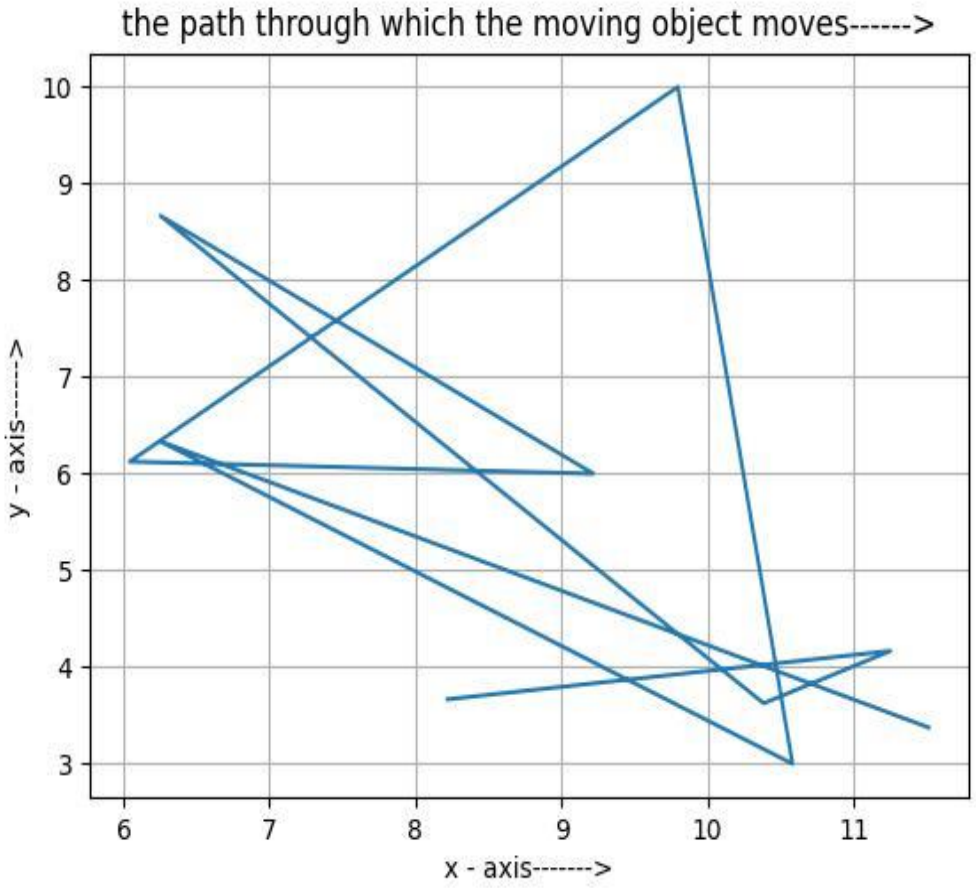


Fig 4.1: The path of the object moves

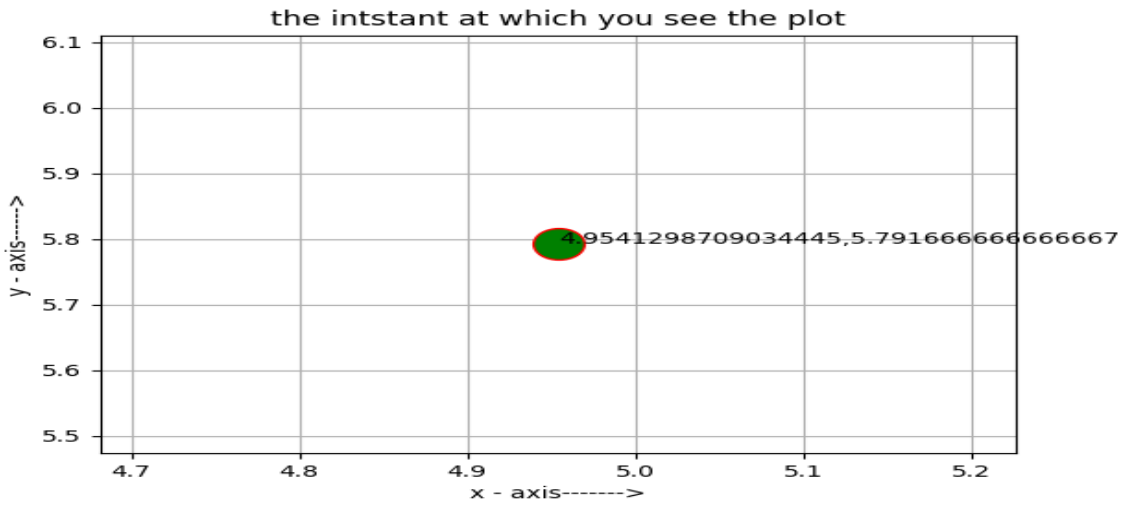


Fig 4.2: the instant at which User want to see the output

The output at the database and in the console as shown below:

To see the output in the control terminal the terminal has to be open and then in the terminal of the console window we first enter the value of the vertical placing of the second reader in a closed environment (one of the walls) then enter the object id in which user want to find the output. Then lists are generated which is contain of the distances from the tagged object to the reader one and reader two as well. Then the co-ordinate generated accordingly in the console window and last but not the list a massage is generated "DATA INSERTED SUCCESSFULLY.....". the console output is shown below.

Console output:

where you want to put the reader in the vertical direction: 12

enter the moving object id for which user want find the location: 55007A1C1B

distance from the tagged object from the reader one:

[12, 1, 11, 2, 1, 11, 6, 11, 12, 9]

distance from the tagged object from the reader two:

[9, 3, 7, 10, 2, 11, 10, 8, 10, 5]

in y direction:

[3.375, 6.333333333333333, 3.0, 10.0, 6.125, 6.0, 8.666666666666666, 3.625, 4.166666666666667, 3.6666666666666665]

in x direction:

[11.515614399588065, 6.253887679764572, 10.583005244258363, 9.797958971132712, 6.0428159826359105, 9.219544457292887, 6.2538876797645715, 10.385536818094671, 11.25339454959653, 8.219218670625303]

enter the Slno you want to see the hen position in the graph: 9

DATA INSERTED SUCCESSFULLY.....

Output at the Database:

```
mysql> use anibrata1;
Database changed
mysql> Select * from track;
+------+-----------+-----------+---------+---------+-----+-------+------+-------------+
| Slno | ReaderFst | ReaderSec | Yaxis   | Xaxis   | day | month | year | timeing     |
+------+-----------+-----------+---------+---------+-----+-------+------+-------------+
|    1 |         8 |        12 | 9.33333 |  4.8074 | 16  | 06    | 2022 | 01:10:36 PM |
|    2 |         9 |         3 |       3 | 8.48528 | 16  | 06    | 2022 | 01:10:37 PM |
|    3 |         2 |         1 |   5.875 |  5.5241 | 16  | 06    | 2022 | 01:10:38 PM |
|    4 |         3 |         7 | 7.66667 | 7.05534 | 16  | 06    | 2022 | 01:10:39 PM |
|    5 |        12 |         5 | 1.04167 | 11.9547 | 16  | 06    | 2022 | 01:10:41 PM |
|    6 |        11 |         2 |   1.125 | 10.9423 | 16  | 06    | 2022 | 01:10:42 PM |
|    7 |         1 |         4 |   6.625 | 6.54909 | 16  | 06    | 2022 | 01:10:43 PM |
|    8 |        10 |         4 |     2.5 | 9.68246 | 16  | 06    | 2022 | 01:10:44 PM |
|    9 |         1 |         7 |       8 | 7.93725 | 16  | 06    | 2022 | 01:10:45 PM |
|   10 |        11 |         4 |   1.625 | 10.8793 | 16  | 06    | 2022 | 01:10:46 PM |
+------+-----------+-----------+---------+---------+-----+-------+------+-------------+
10 rows in set (0.13 sec)

mysql> select * from track
    -> where Slno=10
    -> ;
+------+-----------+-----------+-------+---------+-----+-------+------+-------------+
| Slno | ReaderFst | ReaderSec | Yaxis | Xaxis   | day | month | year | timeing     |
+------+-----------+-----------+-------+---------+-----+-------+------+-------------+
|   10 |        11 |         4 | 1.625 | 10.8793 | 16  | 06    | 2022 | 01:10:46 PM |
+------+-----------+-----------+-------+---------+-----+-------+------+-------------+
1 row in set (0.18 sec)

mysql>
```

Fig 4.3: Database output

In the above shows the data base output. To see the database output first user have to open the MySql client server and then enter the correct use name in ad password to open the server. After doing this things user have to use the database named as Anibrata1 by using the command "use anibrata1;" pressed the enter and then the data base will open and then user can use the table named as track, to axis the data of the track we have to use the command "Select * from track", after pressing the enter key all data will shown which is in the track. To axis the particular data we have to use the keyword "select * from track where Slno=10" after pressing the enter key all the data under the row Slno=10 will show, the above figure shows all the thing which is mention in this procedure.

4.2 Application of tracking algorithm to detected and track the chicken which are suspected to be affected by avian influenza virus:

4.2.1 Introduction:

Avian influenza refers to disease in birds caused by infection with avian (bird) influenza (flu) Type A viruses. These viruses occur naturally among wild aquatic birds worldwide and can infect domestic poultry and other bird and animal species. Infected birds can shed avian influenza A viruses in their saliva, nasal secretions, and faces. Avian influenza spreads meteorically among poultry birds and from birds to humans in contact through the movement of livestock and people, vehicles, cages, and equipment.

Due to its devastating consequences among the poultry industry and livestock farmers, Avian influenza has captured the attention of the international community over the years. Where outbreaks occur, it is often the policy to selectively slaughtering or stop poultry operations, to contain the spread of avian influenza. This represents heavy economic losses for farmers and a long-lasting impact on their livelihoods.

Due to the adverse effects of Avian influenza, it is the need of the hour to detect and separate the infected chickens from the flock at an early stage to curb the spread of this virus among the poultry flocks before it gets throughout the farm and endangers the livestock farmers both health wise and economically.

With the advancements in the field of technology, the cost of digital storage and communication systems have reduced drastically whereas the accessibility and availability has increased which has now eased the monitoring and capturing of the measurements of the condition of individual animals or processes in detail. Different approaches like RFID technology, wireless sensor network, have been used extensively in the last few decades for round the clock surveillance.

There are various symptoms which can indicate towards the fact that a particular chicken might be infected with Avian Influenza virus. Some of these symptoms are loss of appetite, lethargic behaviour of chicken due to weakness, nasal discharge, Decreased egg production, Ruffled feathers, Lack of coordination, etc…. .

Due to these technological advancements, it is now possible to use the above-mentioned symptoms as parameters for a system which monitors the changes in the behaviour of the chickens in real time and detects if they are affected by Avian Influenza virus. The published studies by Subhashish Roy and Prof.Subir Kumar Sarkar mentioned an RFID based system for early detection of Avian Influenza by monitoring few of the afore mentioned symptoms like feed intake behaviour, weight changes and lethargic behaviour of chickens.

Different approaches like wireless sensor network, RFID technology, which have been used extensively in the last decades for round the clock monitoring. Mobile wireless sensors allow continuous livestock monitoring with less costly and greater robustness than would be possible using human observation alone. Hiroaki et al.have proposed Global Positioning System (GPS) based technology to capture the gazing behaviour of cattle which directly enhanced the decision-making capability of farmers to utilize gazing field effectively and preferred habitats of livestock. Mayer et al. have demonstrated a real time system for data retrieval from animal mounted devices which can be implemented via the Global System for Mobile (GSM) infrastructure. Applicability of wireless activity sensor network to avian influenza monitoring system in poultry farms has been demonstrated by Hironao Okada et al.. However, the main challenges faced by the researchers to implement GSM or GPS based real-time livestock monitoring system are battery conservation, cost effective and robust system architecture which can retrieve real time data from livestock accurately and timely. Nowadays the emerging RFID (Radio Frequency Identification and Detection) technology becomes so popular because of its low power, low cost, easy implementation features over other existing state of the art technologies like bar code, sensor network etc. The two main components of RFID technology are electronic transponder or tag and interrogator or reader. Radio or electromagnetic wave is the medium of communication between a transponder circuit and an interrogator which allows us wirelessly reading and writing of data. There are three kinds of RFID technology depending on the cost and architecture like passive, semi passive and active. Passive RFID technology provides very cost effective, long life and easy way of implementing the real time systems.

4.2.2 Procedure for Tracking and Detection (suspected to be affected chicken by avian influenza):

First, we have placed the readers in the right direction. Taking the co-ordinate of the first reader as (0,0) and the second reader is placed in vertically up word direction. Because placing of the two readers in the same axis the x1 and x2 is equal to zero and the value of y1 is equals to zero and y2 taken by the user. For this reason, the distance between two reader is equals to y2. Here I am Appling the triangle law and simple coordinate geometry to locate the co-ordinate of the chicken. First, we have to detect the chicken is affected or not.

The first finding is to detect the chicken is affected or not, so for this reason we have to use one algorithm to find this and according to that a code is generated. The ids of the affected hens are then inserted in to list. According to that user the tracking algorithm to locate the affected hens.

Algorithm:

1. First take the weight of the hen enter int the cage.
2. Note the time of entry.
3. Measure the weight at the leaving time from the cage.
4. Note the exit time.
5. Calculate the time difference between enter and exit.
6. Calculate the weight difference between enter and exit.
7. Check the condition twice.
8. Display suspected chicken
9. And inserted into a list.

Algorithm Flowchart

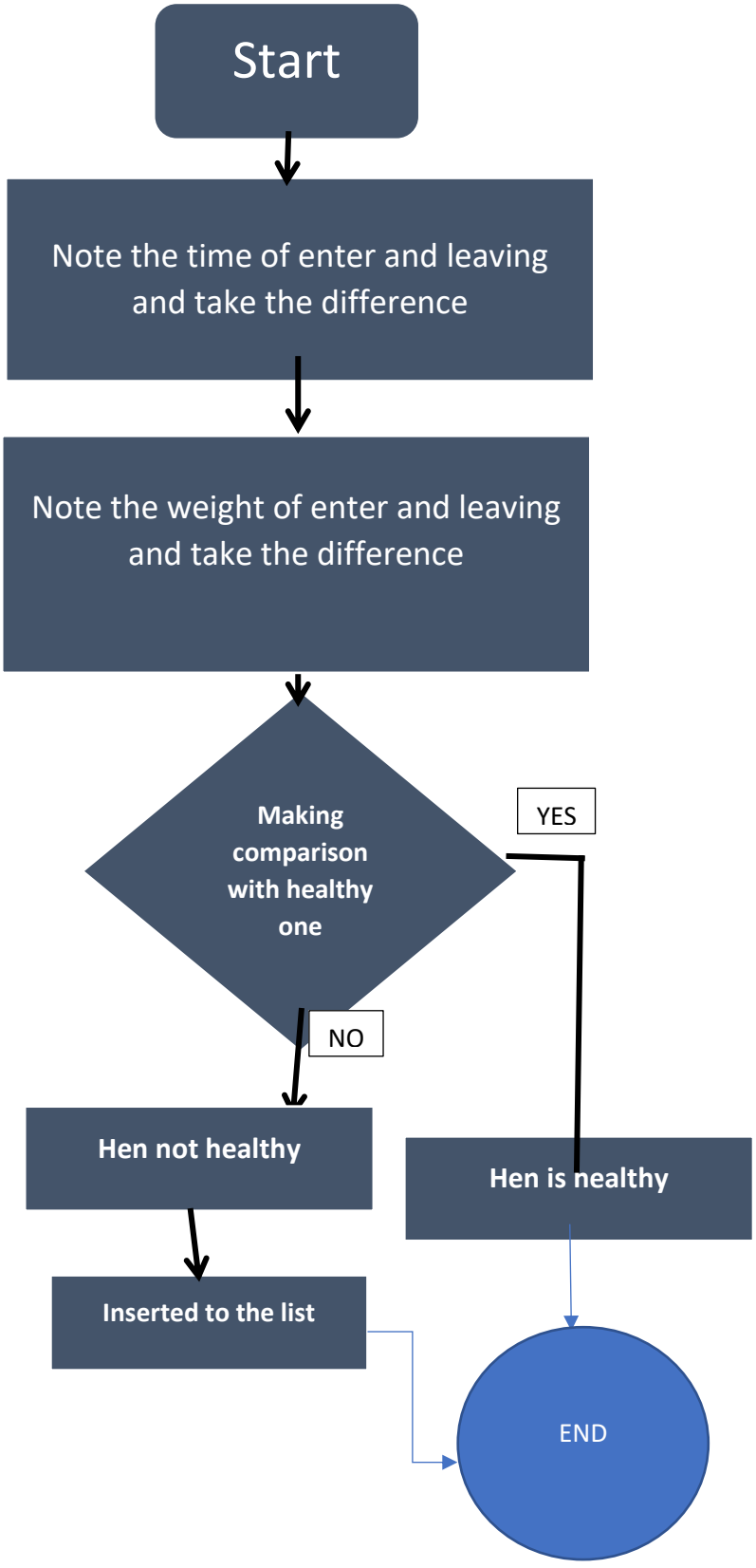


Fig 4.4: flow chart for detection of the affected hen

To identify the hens to be affected hare the lethargic time is calculated and the weight loss is also calculated, because this are the most important symptoms of the avian influenza or bird flu. Then those affected hen-ids are kept in a list. User has to enter the effected hen-id, for which they want to find the location, then this tracking algorithm play its roll. The output are shows in the bellow figure.

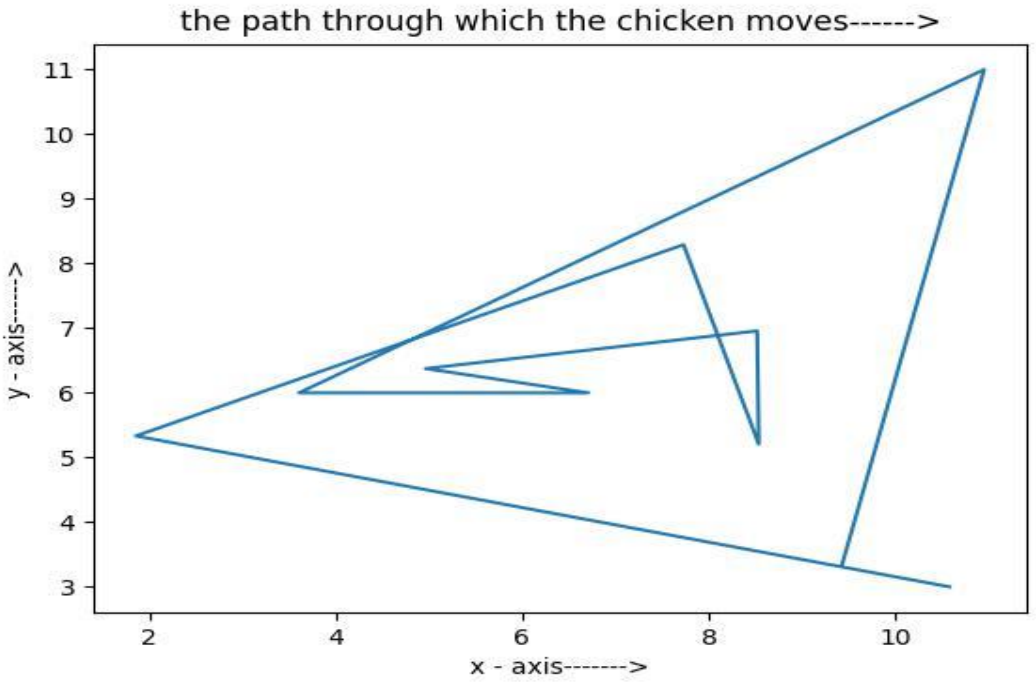


Fig 4.5: The path of the chicken moves

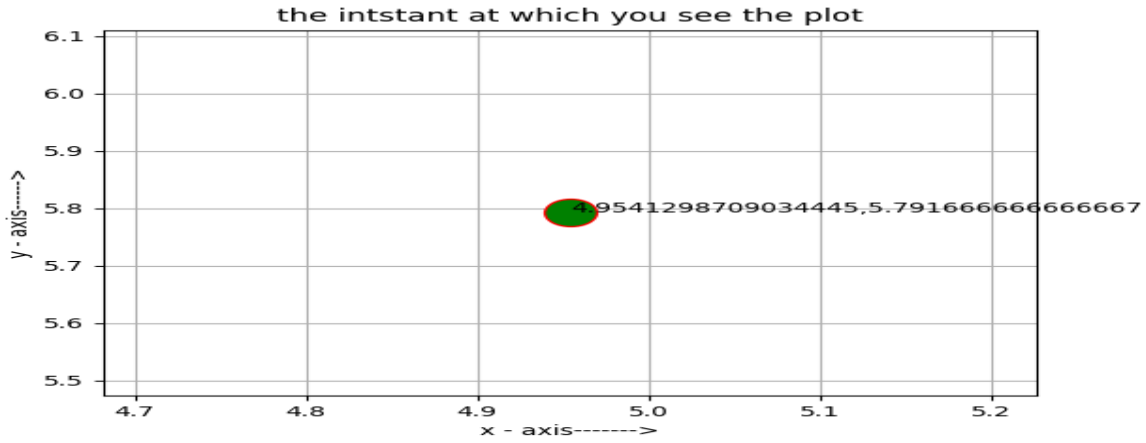


Fig 4.6: the instant at which User want to see the output

The output at the database and in the console as shown below:

Output at terminal:

```
+========+==============+============+
|      1 |       2.6506  | 55007A1C1B |
+--------+---------------+------------+
|      2 |       2.12728 | 5A0084087B |
+--------+---------------+------------+
|      3 |       1.47167 | 550084087B |
+--------+---------------+------------+
|      4 |       2.38894 | 5A0084087C |
+--------+---------------+------------+
|      5 |       2.18664 | 550084086B |
+--------+---------------+------------+
enter the refernce Slno of the hen for which checking is to be done:  1

Hen ID of the refered Hen:    55007A1C1B
Initial weight of referred Hen:    2.65059856873071
Entry Time of the referred Hen:    23:42:18
The measured weight during entry:  2.6410388608517956
Exit Time of the referred Hen:    23:42:34
The measured weight during exit:  2.2534017007920877
The DECREASE in weight for the referred Hen:    0.38763716005970794
The Lethargy time for the referred Hen:    16
Further evaluation of the Hen is required

New Entry Time of the referred Hen:    23:43:11
New measured weight during entry:  2.4093105219477384
New INCREASE in weight for the referred Hen:    0.15590882115565075
New lethargy time for the referred Hen in the non food cage:    37
It is an infected Hen, start tracking algorithm and locate the Hen
```

Fig 4.7: checking for the first hen enter in to the cage

```
Hen ID of the refered Hen:   5A0084087B
Initial weight of referred Hen:   2.127284878870331
Entry Time of the referred Hen:   23:43:12
The measured weight during entry:  2.1697913698626734
Exit Time of the referred Hen:   23:43:30
The measured weight during exit:  2.0506871294737072
The DECREASE in weight for the referred Hen:   0.11910424038896616
The Lethargy time for the referred Hen:   18
Further evaluation of the Hen is required

New Entry Time of the referred Hen:   23:44:09
New measured weight during entry:  2.2834287855432995
New INCREASE in weight for the referred Hen:   0.2327416560695923
New lethargy time for the referred Hen in the non food cage:   39
It is an infected Hen, start tracking algorithm and locate the Hen
.....................................................................
```

Fig 4.7: checking for the second hen enter in to the cage

```
Hen ID of the refered Hen:   550084087B
Initial weight of referred Hen:   1.4716690184027479
Entry Time of the referred Hen:   23:44:09
The measured weight during entry:  1.4321633201983357
Exit Time of the referred Hen:   23:44:27
The measured weight during exit:  1.993356217165167
The INCREASE in weight for the referred Hen:   0.5611928969668314
The Lethargy time for the referred Hen:   18
Further evaluation of the Hen is required

New Entry Time of the referred Hen:   23:44:56
New measured weight during entry:  2.0032183609561423
New INCREASE in weight for the referred Hen:   0.009862143790975164
New lethargy time for the referred Hen in the non food cage:   29
The Hen is absolutely HEALTHY
.....................................................................
```

Fig 4.8: checking for the third hen enter in to the cage

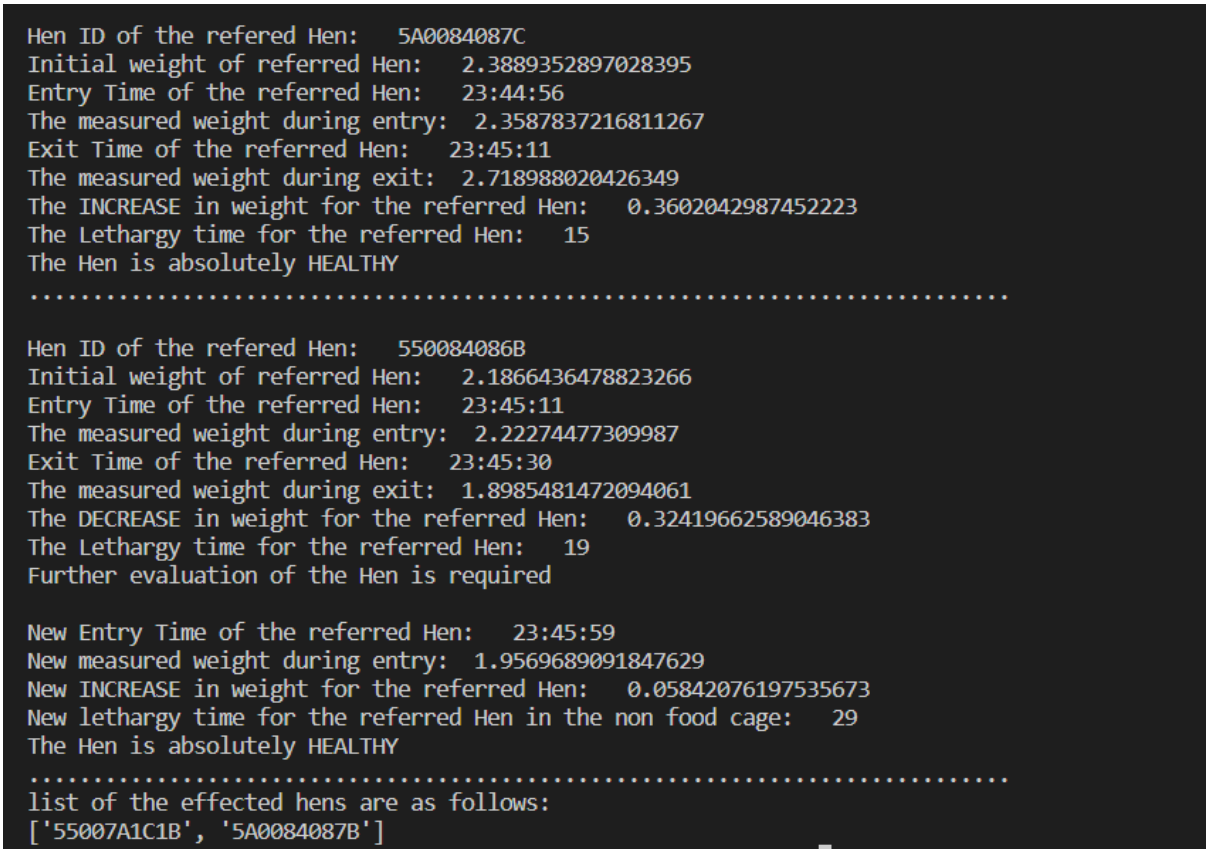


Fig 4.9: checking for the fourth and fifth hen enter in to the cage and generate the list of suspected chicken.

Console output for the tracking suspected chicken:

where you want to put the reader in the vertical direction: 12

enter the hen-id for which user want find the location: 55007A1C1B

distance from the chicken from the reader one:

[8, 9, 2, 3, 12, 11, 1, 10, 1, 11]

distance from the chicken from the reader two:

[12, 3, 1, 7, 5, 2, 4, 4, 7, 4]

in y direction:

[9.333333333333334, 3.0, 5.875, 7.666666666666667, 1.0416666666666667, 1.125, 6.625, 2.5, 8.0, 1.625]

in x direction:

[4.807401700618654, 8.48528137423857, 5.524094948496089, 7.055336829505576, 11.954703281786443, 10.942320366357402, 6.549093448714868, 9.682458365518542, 7.937253933193772, 10.879309490955757]

enter the Slno you want to see the hen position in the graph: 9

DATA INSERTED SUCCESSFULLY.....

Output at the Database:

```
mysql> use anibrata1;
Database changed
mysql> Select * from track;
+------+-----------+-----------+---------+---------+-----+-------+------+-------------+
| Slno | ReaderFst | ReaderSec | Yaxis   | Xaxis   | day | month | year | timeing     |
+------+-----------+-----------+---------+---------+-----+-------+------+-------------+
|    1 |         8 |        12 | 9.33333 |  4.8074 | 16  | 06    | 2022 | 01:10:36 PM |
|    2 |         9 |         3 |       3 | 8.48528 | 16  | 06    | 2022 | 01:10:37 PM |
|    3 |         2 |         1 |   5.875 |  5.5241 | 16  | 06    | 2022 | 01:10:38 PM |
|    4 |         3 |         7 | 7.66667 | 7.05534 | 16  | 06    | 2022 | 01:10:39 PM |
|    5 |        12 |         5 | 1.04167 | 11.9547 | 16  | 06    | 2022 | 01:10:41 PM |
|    6 |        11 |         2 |   1.125 | 10.9423 | 16  | 06    | 2022 | 01:10:42 PM |
|    7 |         1 |         4 |   6.625 | 6.54909 | 16  | 06    | 2022 | 01:10:43 PM |
|    8 |        10 |         4 |     2.5 | 9.68246 | 16  | 06    | 2022 | 01:10:44 PM |
|    9 |         1 |         7 |       8 | 7.93725 | 16  | 06    | 2022 | 01:10:45 PM |
|   10 |        11 |         4 |   1.625 | 10.8793 | 16  | 06    | 2022 | 01:10:46 PM |
+------+-----------+-----------+---------+---------+-----+-------+------+-------------+
10 rows in set (0.13 sec)

mysql> select * from track
    -> where Slno=10
    -> ;
+------+-----------+-----------+-------+---------+-----+-------+------+-------------+
| Slno | ReaderFst | ReaderSec | Yaxis | Xaxis   | day | month | year | timeing     |
+------+-----------+-----------+-------+---------+-----+-------+------+-------------+
|   10 |        11 |         4 | 1.625 | 10.8793 | 16  | 06    | 2022 | 01:10:46 PM |
+------+-----------+-----------+-------+---------+-----+-------+------+-------------+
1 row in set (0.18 sec)

mysql>
```

Fig5: Database output

From the algorithms we can easily track the effected chicken and we are placing two readers in horizontal. In first we have to put the correct hen id to detect which is in the list of effected chicken after that passing through the algorithm plot the path in which the chicken moves. The user has to enter the serial number and accordingly the output will be recorded and plotted into the graph and after that the whole data will be inserted to the database and in the database all the data will be shown accordingly. The bellow figures show the outputs of my works accordingly. To identify infected hens, they are tagged and release in cage. The readers are placed horizontally in one of the walls(axis) of the cage and in this work, we are considering that the distance between the two reader is y2.

4.2.3 Conclusion:

the aim is to try to design an algorithm to trace and locate chicken which are suspected to be affected by avian influenza virus. To identify infected hens, they are tagged and release in cage, the readers are placed horizontally in one of the walls(axis) of the cage. Here by the implementation of this algorithm, the path of the chicken moves can be plotted and last location of the chicken can also be found. In this way avian influenza can be detected early and major financial loss can be avoided.

Chapter 5

Conclusion

5.1 Conclusion:

In this thesis, the aim is to implement and design a tracking algorithm to track the moving object in a closed environment. The concept of RFID is used for this tracking purpose. The experimental study of RFID system has helped to understand the working performance and generating the algorithm to track and locate the dynamic object. The algorithm developed so far can track up to ten different location and create a path which can be visualised through a graph and finally locate any particular location. The experiment result is satisfactory.

5.2 List of key words:

1. RFID
2. Python programming
3. Data Base Management System
4. Primary key
5. Co-ordinate geometry and triangle lows.

5.3 Future scope of work:

The demand of today's world are the technologies that can perform in least time, with least hardware, least cost, least maintenance and best working. Different applications using RFID are now emerging in our daily life by quickly replacing the barcode and other systems. In future there we can implement the things by using image processing to detect the object in batter way and identify them in a batter manner and track them more easily. And the enhancement of the technology the algorithm can be more efferently detect the moving object and use it in mankind. In case a new fetcher can be added with this like if the user provides the time the location of the moving object is immediately shown in the graph and user does not need to provide the serial number.

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