IoT BASED SECURED LOGISTICS MANAGEMENT

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ABSTRACT

This paper deals with secured logistics management using machine learning algorithms like the Gaussian Process Regression algorithm and Stochastic Gradient Descent algorithm. Logistics is one of the key elements of supply chain management; the main objective of logistics is revealed in managing the flow of goods, services, and information efficiently and effectively at the right time and right quantity at the right place with the right devices to satisfy customers. Internet of things (IoT) can establish a huge scale of smart infrastructure to merge products, physical objects, data, information, processes of a supply chain and build a secure and smart system of SCM. Internet of Things is facilitating smart and connected supply chains. Logistics combined with IoT allows users to migrate applications and their data toward the server. Instead of using expensive applications and resources on a station, users take advantage on-demand applications and resources with minimum cost. An IoT system is a network of networks that connects a huge number of things, objects, devices, and sensors through communications and information infrastructure to stipulate value-added services through intelligent data processing and management for diversified applications.

Keyword*-stochastic gradient, think speak, logistics, traceability, uncertainty.*

1. INTRODUCTION

Logistics management is an important aspect of real-time applications. Some of the aspects like a delay in delivery, identification of freight vehicles in real-time, cargo overload and misplacement are some of the issues facing logistics management. The Global Positioning System monitors the position of the cargo according to its latitude and longitude positions. Smart logistics is based on modern advanced information and communication technology (ICT). It can realize the modern integrated logistics system intelligently by real-time processing and comprehensively analyzing the information of all aspects of logistics. Smart logistics can bring end-to-end visibility, improve the way of logistics transportation, warehousing, distribution processing, distribution, information services, and so on, and can contribute to time and cost savings. The Internet of Things triggers the communication between sensors, various modules, people and internet protocols in an efficient manner. The prime goal of IoT is to connect the physical world with the people and facilitates users with more functions that were not possible in the traditional approaches. The acquired coordinates of the vehicle will be transferred to the central server. The users can visualize the updated data from the vehicle through website. The regression model works under unstable traffic conditions and guarantees a massive revolution in logistics over the next decade, as it creates new business benefits by minimizing the price of device components (sensors, actuators, and semiconductor devices), increasing the speed of wireless networks, as well as expanding the ability to receive data. Secured logistics management promises protracted payoffs for logistics operators and their business customers and end consumers. Secured logistics management has great impact in the areas such as operational efficiency, safety and security, customer experience, and new business models. To successfully implement IoT in logistics will require strong collaboration, along with high levels of participation between different players and competitors within the supply chain, and a common willingness to invest. But the advancements in logistics will always depend on the ability of innovation of the logistics minds and operators.

2. LITERATURE SURVEY

Secured logistics management operations are constructed to facilitate the safe management and movement of goods, information, and other resources between a specific point of origin and its final destination. In some cases, these same strategies can be applied to fixed locations as well. Currently, the fields such as AI, ML, and deep learning are widely talked about and are often used as alternatives for each other; however, they have their differences.

2.1 A Smart and Secure Logistics System Based on IoT and Cloud Technologies

Ilaria Sergi proposed solutions to track and monitor goods conditions during their transportation. The cold chain requirements will guide both the design and the development of an IoT device to be installed in the truck to monitor the selected parameters. With the proposed solution it is possible to exploit fast prototyping tools and technologies to rapidly implement innovative solutions that ensure the highest level of security in products, services, and processes in logistics and address the risks and threats satiny the level.

2.2 Smart Solutions for Logistics and Supply Chain Management

Gamal Abd El-Nasser proposed a survey of applications of smart technologies - Cloud Computing, Big Data Analytics, Internet of Things (IoT), and Blockchain on supply chain management and logistics. Smart solutions offer an effective share of tracking information such as condition, location, and environment of goods, and processes at any time, anywhere, it helps to obtain valuable knowledge from enormous amounts of data, facilitates data-driven decision-making, also helps to provide extended customer value, transparency, cost reduction, acceleration of transactions and enhanced service network in SCM.

2.3 A Blockchain-based secure storage scheme for logistics data.

Hongzhi L proposed and implemented a blockchain-based logistics scheme. To be specific, logistics requests from users are aggregated into the user chain; then, logistics providers could choose logistics orders according to their demands. Furthermore, the logistics data from IoT devices are collected and aggregated into a Data chain to ensure that all the stored logistics data cannot tamper with. Several simulations are carried out to evaluate the performance of our system. Analysis and evaluation show that our proposed scheme is effective and feasible for the storage of logistics data. Further studies are still needed in the future.

2.4 IoT-based smart logistics management system using GPS and GSM.

Dr. C. Amali, K, and Dr. D. Sridevi proposed a system that focuses on tracking goods, and freight vehicles using IoT and open-source hardware. With this device the freight vehicle can be monitored from anywhere and delay and stealing of vehicles can be avoided. The combined GPS and RFID system is ideally adapted for real-time localization. The weight sensor activities are controlled by the open-source hardware Arduino Uno. The weight sensor senses the weight of the product of the cargo, if the cargo is overloaded then a message will be sent to the administrator and the cargo driver notifying the status of overloading.

3. PROPOSED METHODOLOGY

The secured logistics management is based on data, which is collected through several Sorts of sensors like Node Microcontroller, GPS, and temperature sensors. The node MCU Gathers latitude, longitude, and temperature from these sensors continuously and sends the data To the think speak server using the internet. Machine learning is used to find the accuracy of the Output results. Here we are using the Gaussian Process Regression(GPR)and the Stochastic Gradient Descent(SGD) algorithm for accuracy and classification. The final output will be displayed in a proctored website developed using Python - Django.

3.1 GAUSSIAN PROCESS REGRESSION (GPR ALGORITHM)

Gaussian process regression (GPR) is a non-parametric, Bayesian approach to regression that is making waves in the area of machine learning. GPR has several benefits, including working well on small datasets and having the ability to provide uncertainty measurements on the predictions. Gaussian process regression is non parametric(i.e., not limited by a functional form), so rather than calculating the probability distribution of parameters of a specific function, GPR calculates the probability distribution over all admissible functions that fit the data. Gaussian process regression is a popular approach to tuning the hyper parameters of the covariance kernel function to maximize the log marginal Likelihood of the training data.Gaussian process regression (GPR) models are non parametric kernel-based probabilistic models with a finite collection of random variables with a multivariate distribution. Every linear combination is evenly distributed.It is based on the notion of the Gaussian distribution to be an infinite-dimensional generalization of multivariate normal distributions. Gaussian processes are utilized in statistical modeling, regression to multiple target values, and analyzing mapping in higher dimensions. For each GPR model, we will be Training a data set with GPR models, Prediction Speed, Training Time, and Analyzing the results of each Gaussian process regression to see the similarities and differences of the data. The updated distribution $p(w \mid y, X)$, called the posterior distribution, thus incorporates information from both the prior distribution and the data set. To get predictions at unseen points of interest, the predictive distribution can be calculated by weighting all possible predictions by their calculated posterior distribution.

3.2 STOCHASTIC GRADIENT DESCENT (SGD ALGORITHM)

Stochastic Gradient Descent (SGD) is a simple yet very efficient approach to fitting linear classifiers and regressors under convex loss functions such as (linear) Support Vector Machines and Logistic Regression. SGD has been successfully applied to large-scale and sparse machine learning problems often encountered in text classification and natural language processing.SGD is merely an optimization technique and does not correspond to a specific family of machine learning models. Stochastic gradient descent is an optimization method for unconstrained optimization problems. In contrast to (batch) gradient descent, SGD approximates the true gradient of $E(w,b)$ by considering a single training example at a time. The class SGD Classifier implements a first-order SGD learning routine.

4.DEVELOPED METHODOLOGY

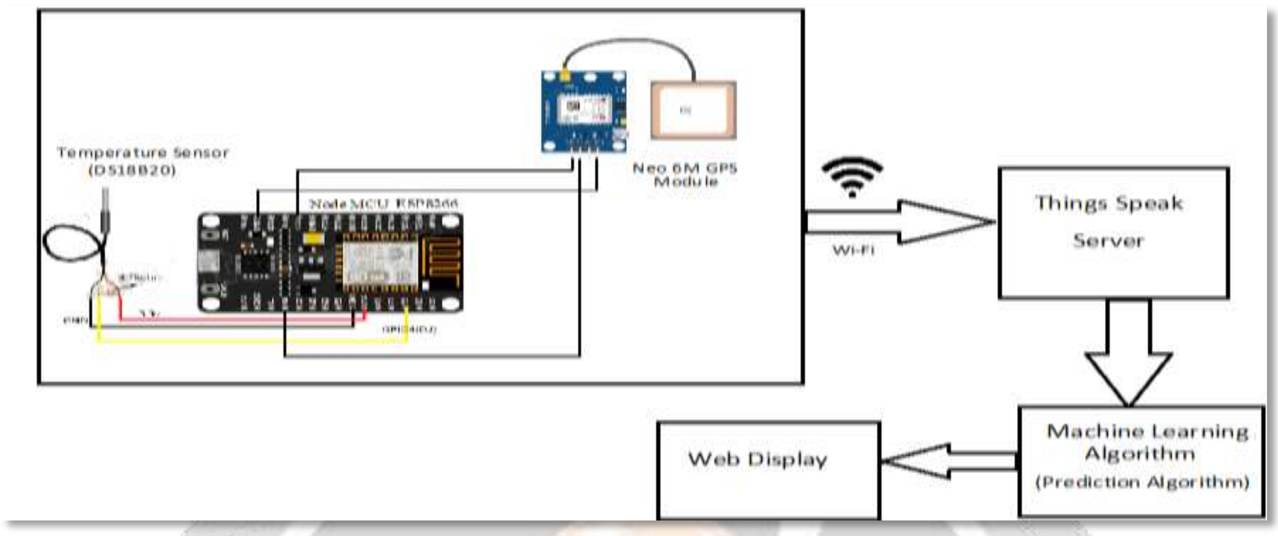

Fig.1 block diagram(Schematic)

The above figure represents the block diagram of the receiver and transmitter side of the Project.The parameters such as temperature and location will be collected from the node MCU stored to the think speak server. Then the collected data will be processed and the data will be trained by using SGD and GPR algorithms where the code is written in python language. The estimated time of delivery will be calculated using the algorithms and the final output will be displayed on a website.

5.RESULTS AND DISCUSSIONS

5.1 Overall Setup

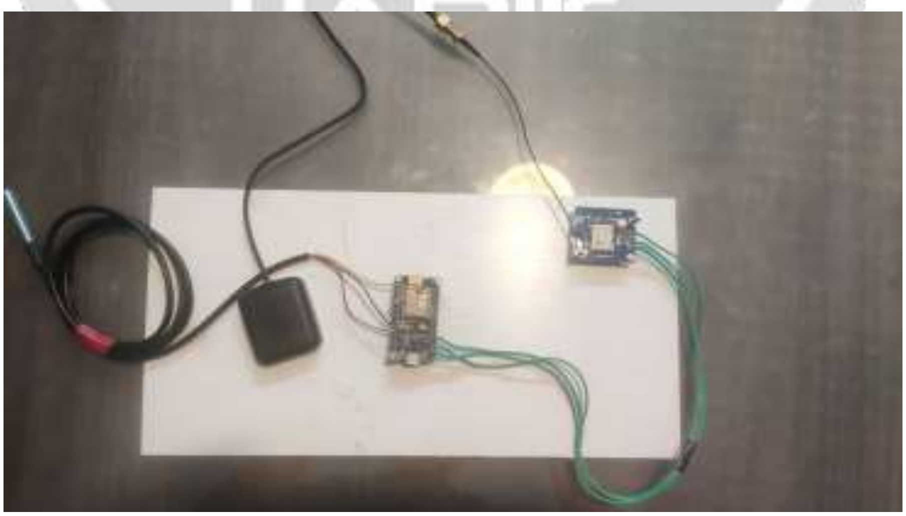

Fig.2 Overall Setup

5.2 Stochastic Gradient Detection (SGD Algorithm)

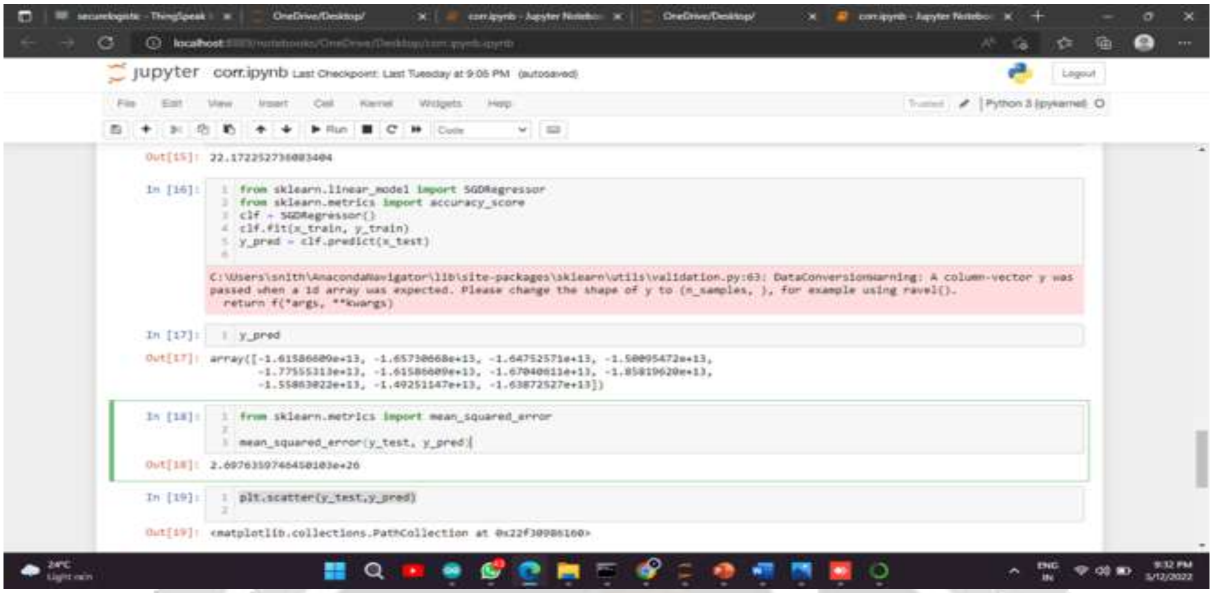

Fig.3 Estimated time of delivery using GSD

5.3 Stochastic Gradient Detection (SGD Algorithm)

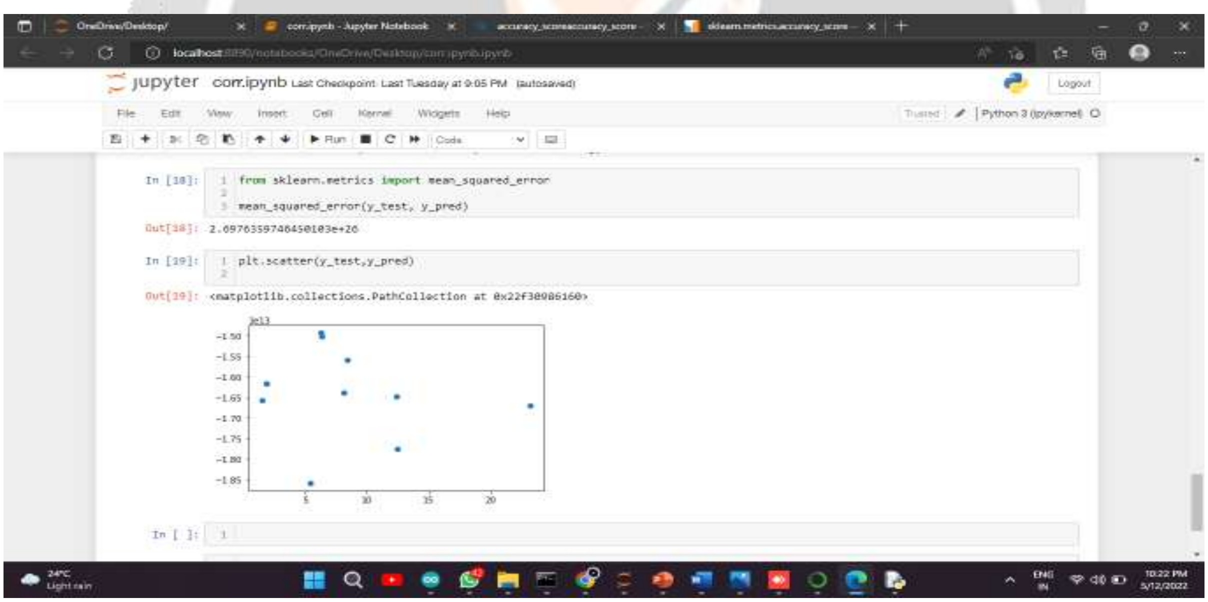

Fig.4 Estimated time of delivery using GSD with graph

5.4 Gassian Process regression (GPR Algorithm)

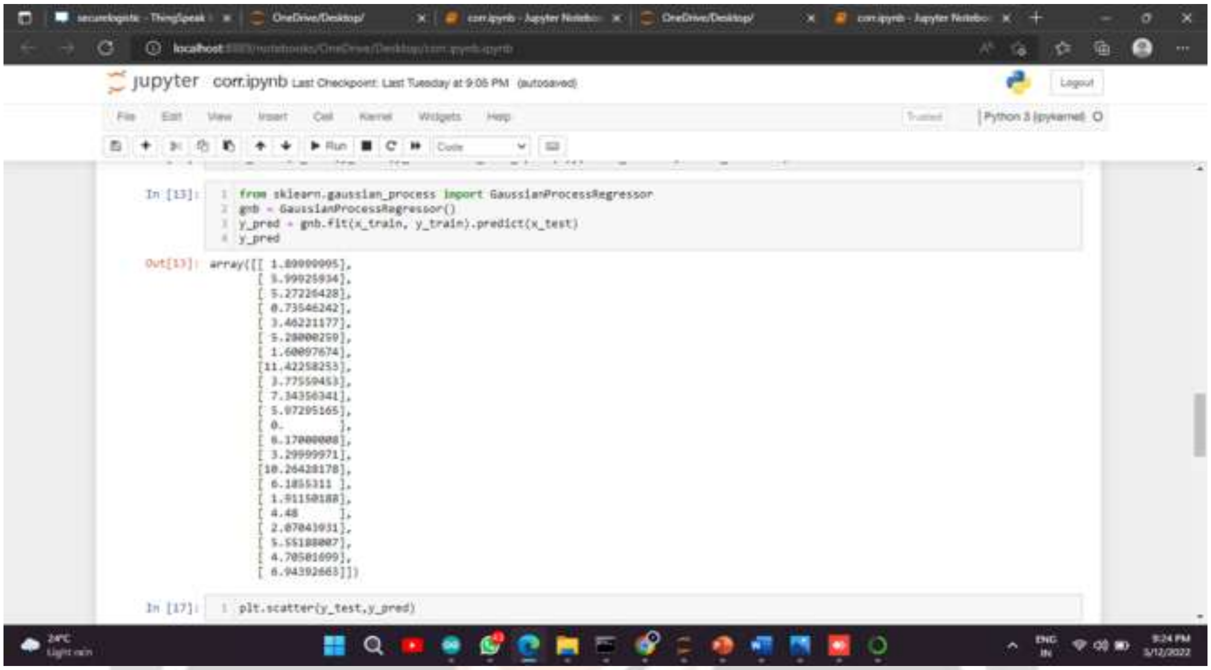

Fig.5 Estimated time of delivery using GPR

5.5 Gaussian Process regression (GPR Algorithm)

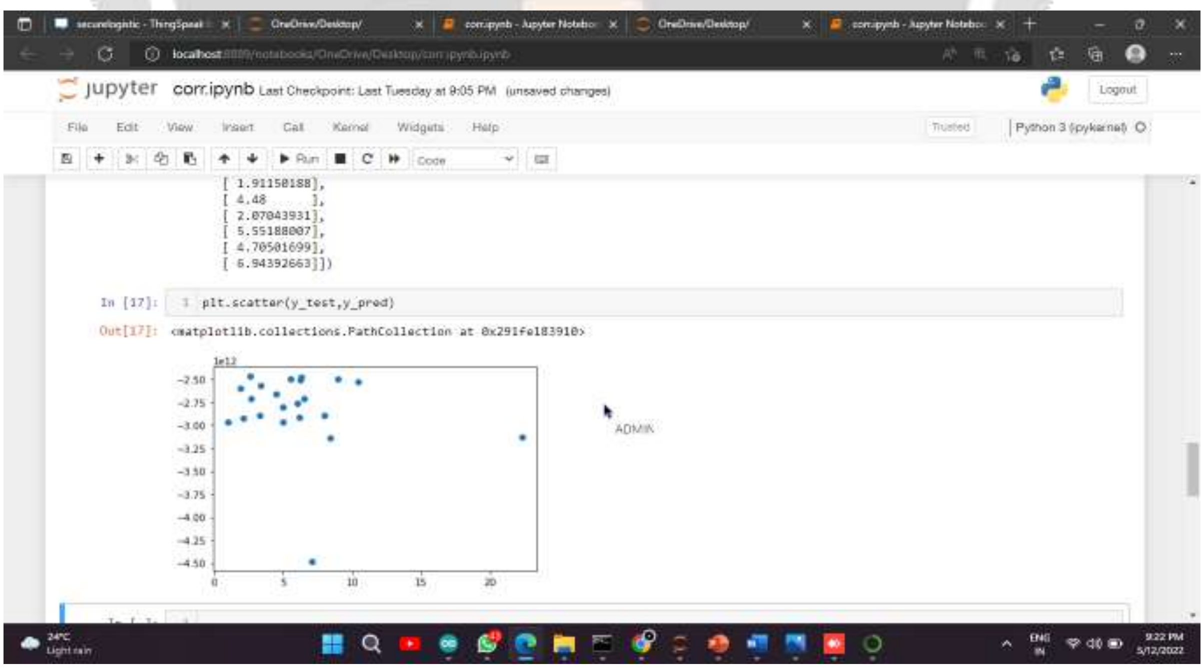

Fig.6 Estimated time of delivery using GPR with graph

5.6 Thinkspeak

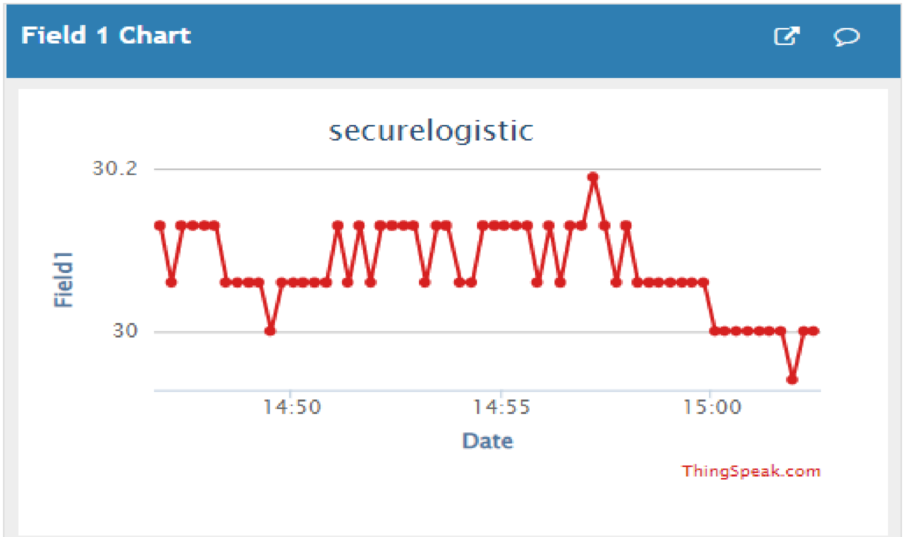

Fig.7 Temperature Detection

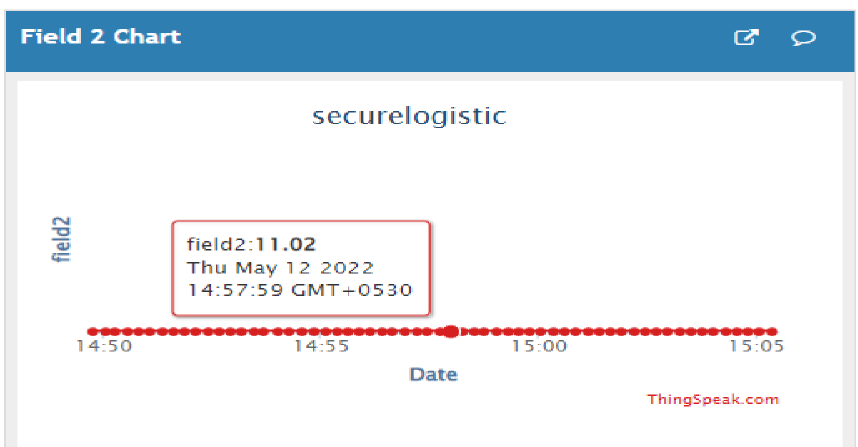

Fig.8 Latitude Detection

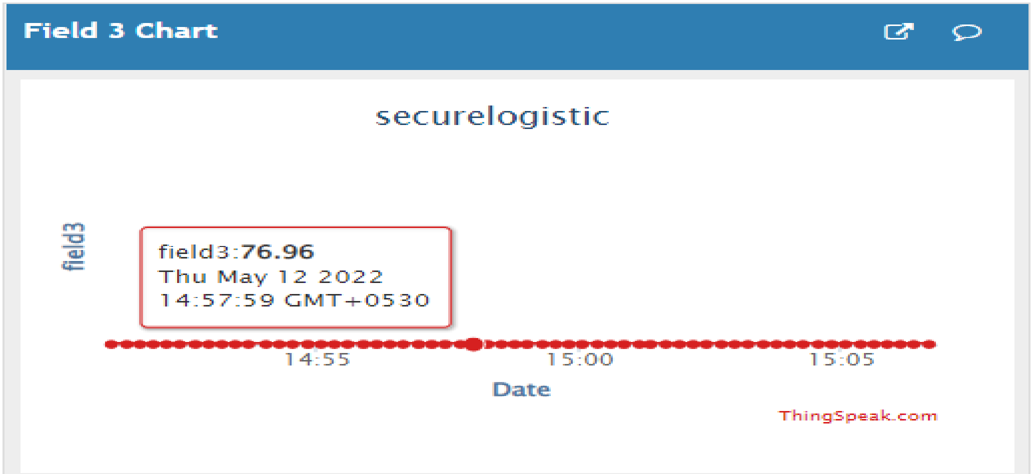

Fig.9 Longitude Detection

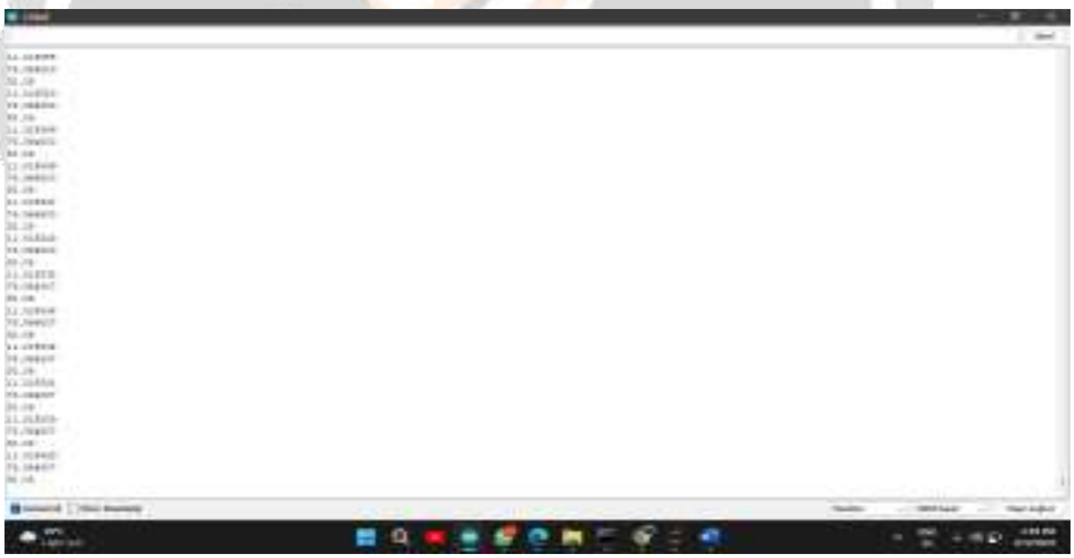

Fig.10 Experimental Setup

The below figure shows the predicted time to be reached by the destination(Mumbai) from the source(Coimbatore) that has been predicted and displayed.

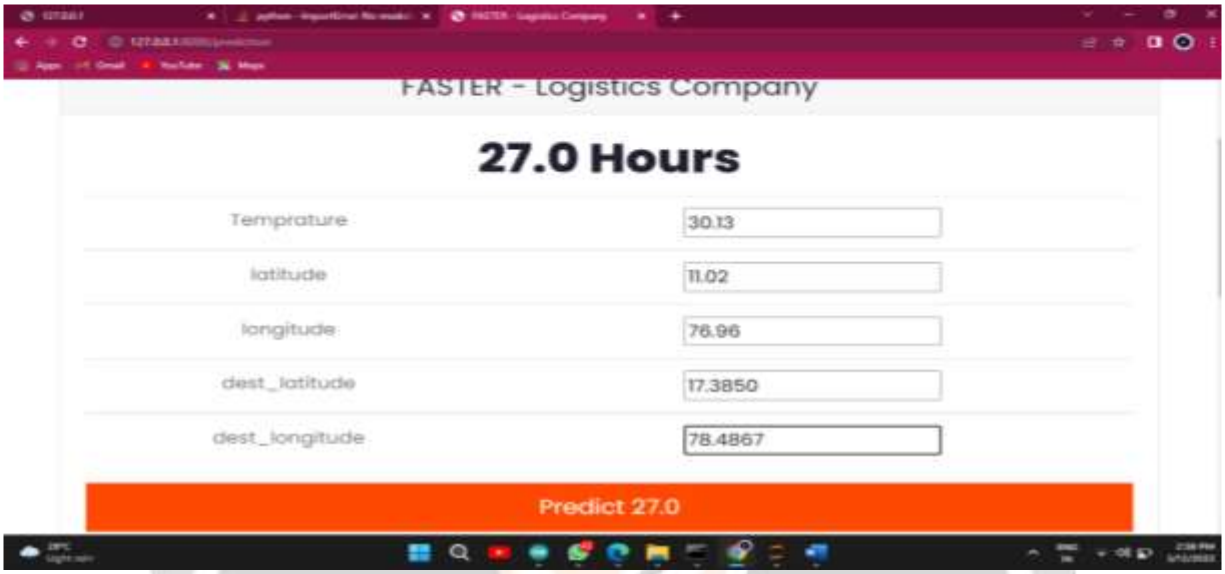

Fig. 11 Final Output

5.7 Accuracy

The source of the latitude and longitude is taken into consideration for prediction by the algorithms and is trained and compared with the destination latitude and longitude. The values will be trained using algorithms and the output will be displayed. The predicted output will be compared with the training data for accuracy purposes and estimates how close the values are when compared between the training data and the predicted output. The below table explains the accuracy predicted when compared from training data and to the predicted data.

S1	S2	D1	D2	ETD (hours)	Training Accuracy	Predicted Accuracy
11.02	76.96	17.3850	78.4867	27	100%	83%
10.99	77.00	11.5034	77.2444	2.48	100%	87%
10.99	77.00	11.0102	76.8456	16.1	100%	79%
9.9252	78.119	12.6819	79.9888	12	100%	81%
8.7642	80.270	11.0102	76.8456	13.4	100%	93%
17.3850	78.4867	11.0168	76.9558	17.9	100%	90%
11.0168	76.9558	9.9312	76.2673	5.62	100%	97%
13.0827	80.2707	9.9252	78.119	2.82	100%	98%
12.9716	77.5946	9.9312	79.0875	1.73	100%	99%
11.9416	79.8083	11.0168	76.9558	27.7	100%	88%

Fig. 12 Accuracy table

6.CONCLUSION

The logistics sector needs to use innovative IoT technologies to automate, simplify and make its processes more efficient. Different works have already been proposed in the literature to propose solutions to address such requirements, however, considerations for security and privacy issues need to be deeply investigated paying attention to data from the end device. The traceability of consumer products would improve Europe's ability to fight fraud and take action against unsafe products. This would be possible through comprehensive control of the goods that reach our borders, including details such as date and place of entry as well as the origin and destination of the imports. It also stresses the importance of monitoring and control of the goods at any time and place, since this would decrease the effects of dangerous goods that could enter our borders or thefts that may arise. For other possibilities in non-commercial situations such as disasters and emergencies, an effective supply chain for essential goods can mean the difference between life and death. Particularly, tracking and tracing goods is a process of determining the current and past locations of a unique item or property, reporting the arrival or departure of the object, and recording the identification of the location, the time, and the status.

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