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# Smart Shipment Tracker

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***Abstract***

*Since the beginning of human civilization, people are involved in shipping goods. Shipment involves different stages, from source to destination; a consignment goes to different places before getting delivered. At every stage, they verify the details of the shipment & save it in their database. But due to an increase in cyber-attacks, these details get leaked & are misused. Also QR codes that were printed on the shipment could be damaged easily. In this paper, we use RFID instead of QR codes to save shipment details, use GPS to track the shipment, and all the data is stored in a blockchain. This ensures high-level security & prevents hacking. The results we got were highly satisfactory. Further modification in the system will make it more efficient & robust.*

***Keywords*** *— Radio-Frequency Identification, Global Positioning System, blockchain, Tiny GPS, Supply Chain Management.*

## INTRODUCTION

Supply chain management manages the flow of goods and services and includes all processes that transform raw materials into final products. It involves the active streamlining of a business's supply-side activities to maximize customer value and gain a competitive advantage in the marketplace. SCM represents an effort by suppliers to develop and implement supply chains that are as efficient and economical as possible. Supply chains cover everything from production to product development to the information systems needed to direct these undertakings[1]. But logistics remains the most important aspect of supply chain management. The consumer is always eager to know when they'll receive their product; the shipment company needs to know the details of shipment without much effort so that the process is carried out seamlessly.

This project presents a viable system for online shipment tracking using RFID technology. It aims to find the location where exactly it is at an instance of time, from shipment to the time of delivery. The system has a developed web-based database-driven application that facilities its management and provides useful information about the shipment. In a supply chain, these characteristics reduce the number of intermediaries, including the former keepers of trust along the chain.[2] This will increase efficiency and reduce overall costs. In that regard, we also saw that the future combination of blockchain with IoT technologies would help the different stakeholders ensure traceability and reduce risks. Sharing a unique blockchain across the different supply chain stakeholders (production, freight, and consumer) will ensure that the exchanged and manipulated wares are authenticated, thus preventing potential fraud and making information accessible. IoT, [1]on the other hand, will link the physical and the digital world by providing reliable information on the blockchain's materials and products. Today, IoT and blockchain technologies are in constant evolution and need to mature to support those kinds of challenges. Nevertheless, actors actively integrate these technologies into the supply-chain world and propose new ways to improve and continually secure information sharing. Overall, these technologies will revolutionize how the different actors in a supply chain capture, communicate, and access information on a secure, shared, and transparent platform.

### *Literature Review*

**AMAZON:**

Amazon employees used to roam warehouse floors to scan for each product; now, they use Wi-Fi-connected robots provided by Kiva Systems – which Amazon acquired in 2012 – to identify products by reading QR codes using built-in cameras. The AI system assesses which products are to be prioritized for Amazon Prime orders, for example, and the robots do the rest. While this takes place, workers can focus on packaging an order or restocking shelves. It's robots and humans working side by side through IoT

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**VOLVO:**
Volvo uses cloud-based services and IoT technologies to support the logistics side of its supply chain in ordering components from different countries to shipping vehicles to suppliers across the world. The company told V3 it was using the cloud because these services give them greater flexibility over on-premise setups.
Transportation and fleet management are an important part of the supply chain and logistics business, and IoT is already making waves in this space if you could have visibility over your entire fleet so that you know exactly where each truck might be and when, and which is the best route for it to take on any given day (and when it might need servicing…) you'd probably do it.
That's exactly how IoT technology has helped DART. Based in Dallas, Texas, DART is one of the largest public transport providers in the United States; it transports over 100 million passengers a year. Using Cisco's Internet of Things systems, it is monitoring and optimizing its entire fleet's performance.

**DECATHLON:**
Track and trace is the most common form of IoT in the supply chain, and several firms are seeing real rewards from getting ahead with this technology.
Decathlon – a sports retailer that owns 850 stores in 22 countries, is a prime example.
It's using IoT technology, such as radio frequency identification (RFID) from Checkpoint Systems, in more than 400 of its stores and plans to extend its use of RFID tagging to millions of its products worldwide.
Supposedly, the tracking technology ensures Decathlon's products are delivered to vendors with 100% accuracy every time, and items arrive shelf-ready, which saves employees time by not manually checking each delivery.
Internet of Supply Chain is the only event bringing together Supply Chain executives representing the retailers, manufacturers, and logistics operators to share best practices and inspire new revenue opportunities. The two-day forum will offer unheard before case studies on how the total lifecycle of a product can be monitored in real-time and be delivered on time and without any compromise in quality. Key themes will include using IoT to improve end-to-end visibility, modernize a legacy supply chain process, and marry manufacturing and supply chains.

**Methods & Materials**

- For our smart shipment tracking system, we'll use the Arduino interface. We connect Arduino with an RFID scanner & another Arduino will be connected to a GPS sensor. The data is sensed using Arduino& the sensors, then using Cool Term software; we'll convert the fetched data into a text file. That file we'll pass as input to HTML form created using HTML. Then the data will be stored in blocks.

The hardware components used in the project are:

- Arduino Uno board
- RFID
- EM-18 READER MODULE
- Neo 6m GPS module
- Breadboard
- Jumper wires
- Power Supply

For software requirements, we'll use Arduino IDE, HTML, PHP.
The different components of this system are:

***A. Sensing Component****:* The sensing component includes a small GPS sensor plug-in device with a comprehensive, customized client sensor suite that can be placed inside the cargo or the pallets.
Sensing technology will become a critical part of shipment tracking. Solutions today often use radio frequency identification (RFID), which is electronic labeling and data collection system using RF signals (low, high, ultra-high, and ultra-wideband) to identify individually tagged objects or personnel. Sensor technology, such as RFID, combined with wireless communication represents the most significant technological breakthrough because it's a foundational tool that captures and communicates data about how packages move from one place to another. Sensors can be attached to products or placed in packaging to monitor critical parameters such as temperature, pressure, and vibration during transit.

***B. Analytics Component*****:** The analytics component is a blockchain technology that uses the device sensor data in combination with other data sources and turns them into actionable information, e.g., intrusion alert message, fulfilment and performance analysis of shipments, triggering events workflows. The goal is to correct negative trends before they become costly.

***C. Operations Component***: The operations component makes sure that the devices are available at the client when a shipment starts or devices are picked up at the moment the shipment is over.
***D. Blockchain*****:** The data is transferred into an HTML webpage; from there, it is sent to the blockchain, each field is entered into a block. Whenever we want, we can retrieve the data.
***Working:***
Generally, GPS tracking uses a system of satellites orbiting the earth to find the actual location. We can store shipment details in RFID & by scanning it, we'll know about it.

- Every shipment will have RFID & GPS tags

- These tags will contain all the details about the shipment.
- The data will be stored in the form of encrypted ledgers in the blockchain system.
- By scanning the tags, we'll get to know about the shipment.
- By enhancement in technologies & application, this system can become completely automatic.
- Replacing slow, manual processes & strengthening traceability, this system will make SCM more reliable & accurate.
- All the data is stored in the blockchain using an HTML form.

**Pseudo code to read RFID:**

```
while(Serial.available()){
n++;
charinChar=(char) Serial.read();
inputString += inChar;
if(n>=12){
    n=0;
stringComplete = true;
  }
```

**Pseudo code to get GPS location:**

```
while (gpsSerial.available() > 0)
if (gps.encode(gpsSerial.read()))
displayInfo();
if (millis() > 5000 &&gps.charsProcessed() <
10)
  {
Serial.println("No GPS detected");
while(true);
  }
```

- ***Figures and Tables***

For Shipment Details:


**Fig i: The process of reading & storing shipment details**

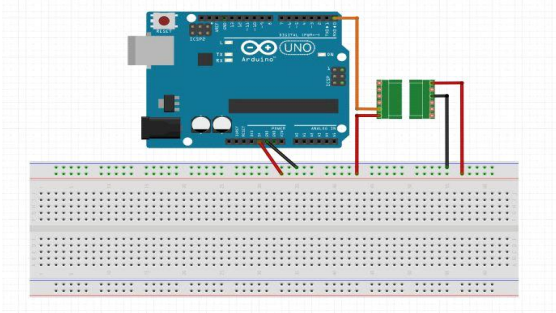

**Fig ii: Interfacing EM18 with Arduino Uno**

**For Shipment Location:**

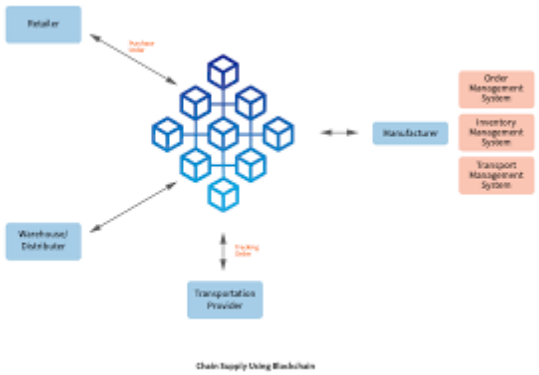


**Fig iii: The process of detecting & storing shipment location**

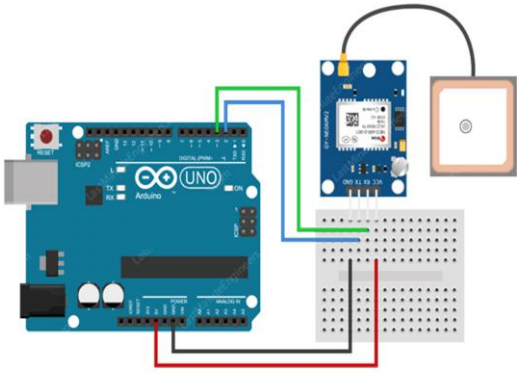

**Fig iv: Neo 6n GPS Module interfacing with Arduino**

## CONCLUSIONS

After seeing all the results, we can say that this system is successfully built. The results are satisfactory. This project will help in real-time problems faced by supply chain industries. RFID will be more durable & secure when compared to QR. If any shipment is lost or is misplaced, we can track it down using GPS. Only the company & the customer will know the details as all the details are stored in RFID; thus, privacy is maintained. Live tracking is possible since every shipment will have GPS tags. There is no chance for anyone to hack & steal the data as it is stored in the blockchain. We can always enhance the features & make the system more robust.

Some of the points which can help in enhancing this system are:

With the focus on Flask, we can make better UI to feel at ease in handling the system.

Currently, we have used Arduino Uno for this system, but to make it compact, we can build ICs.

More powerful blockchain concepts can be used to make the system even more secure.

API's can be developed to transfer the data directly from Arduino to HTML forms.

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