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# Automation in supply chain management using Internet of Things

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**Abstract: -** The Automated Supply Chain Management (SCM) framework involves real-time GPS location monitoring of transport fleets and RFID-based shipment tracking at the warehouse point of entry and exit. A device design and implementation of the same was proposed in this paper using the GPS location tracking system based on Arduino and SIM808 for restricted power application. For a shipment monitoring device based on MQTT at the depot, the Raspberry Pi and RC522 RFID Reader are used. A robust integrated supply chain management system is created by the combination of both components, and can be used by logistics firms to track and control their logistics using a web-based Interface. The Internet of Things (IoT) platform is used for the exchange of data from sensors to HTTP POST and PHP server systems and in later situations, Cloud MQTT.

**Key Words: —** ***IoT, Raspberry Pi, Arduino, Supply Chain Management (SCM), HTTP, MQTT, RFID, IEEE 802.11WLAN, GPS, SIM808.***

## I. INTRODUCTION

In this new age, there is a very critical position for technology for every industry to be competitive. As the market is competitive, knowing the consumer base is crucial. As the predicting and fulfilment of consumer demand has become difficult, it can be a boring job without good cooperation between different business partners. This has driven enterprises into diverse tech applications to fill this void and use the prominent data kit to satisfy the demand of the smart world. A analysis to assess the viability of IoT in the field of supply chain management (SCM) has been undertaken to resolve this problem. Any product must cross several business partners from producers, vendors, and fulfilment centers to retailers in every business phase before reaching the consumer. It hits the customers after all that. At any point of the supply chain, it is also important for the business management system to have the visibility of the product to provide accurate details about the name, location and other information relevant to the object's monitoring. It is crucial for each business to be mindful of where the commodity is physically stored within the supply chain by ensuring a delicate relationship between the middle man and the customer and maintaining a cost and time balance as well. This research has helped us to bring about the need for transport supply chain management (SCM). The IoT is a network of physical objects used for convergence, sensing and connectivity to share data with the maker or the customer. The term "stuff" or embedded devices in IoT are interconnected by a public or private network. It also refers to the special ID used for sensing, tracking, and self-configuration to influence the business process for proper integration between digital and real-world applications. It also moves into intelligent logistic management and data mining with its popular implementations in diverse domains. We see that data processing plays an important role in the loyalty of consumers and ensures a balance between cost and time at the same time. This is done by putting in place

RFID, which makes the business conscious of where the commodity is. The primary aim of designing a multimodality framework is that it can be used for multiple purposes. A wireless Raspberry Pi sensor is used in this framework. All the sensor values are obtained using this method. For reduced power restriction applications in IoT, Arduino is more suitable. Therefore, as seen in the comparative review of device requirements, a comparative study indicates that Raspberry Pi is more suitable for Linux-based RFID shipment tracking MQTT application platform and Arduino would be more suitable for battery driven handheld real-time GPS location tracking module

## II. LITERATURE REVIEW

S.Kalaivanan and S.Manoharan, "Monitoring and controlling of smart Homes using lot and low power Wireless Technology," Indian Journal of Science and Technology, Vol. 9, October 2016

IOT is a physical object network that is embedded with hardware, software, sensors and networking to allow objects to share data with the connected manufacturer/operator/other devices. The goal of this paper is to track and regulate the smart home system from anywhere in the world. It is also expanding into smart homes and more and more IOT apps in different realms. One of the most important technologies using IOT is the Smart Home Framework. The ZigBee technology is used in this paper for the networking of smart things, i.e. objects to be tracked and managed. The smart

home system consists of numerous sensors for monitoring the smart home system, such as a temperature sensor, motion sensor, air flow sensor, ultrasound sensor and actuators. The ZigBee modules that are attached to Arduino boards are connected to these sensors. This configuration forms a WiFi modem network from which the tracked data is inserted into the internet server. An android application is created to allow the user to track his/her home anywhere in the world. It also analyses the efficiency of IEEE 802.15.4 (ZigBee), which contains parameters such as SNR and BER.

Atzori L., Iera A., Morabito G., "The internet of things: A survey", Computer Network, Elsevier, Volume 54, Issue 15, October 2010, Pages 2787 -2805

The convergence of many innovations and connectivity solutions is the principal supporting component of this promising paradigm. The most important are detection and monitoring systems, wired and wireless sensor and actuator networks, improved networking interfaces (shared with the Internet of the Next Generation), and distributed intelligence for smart objects. Every significant contribution to the development of the Internet of Things, as one would easily understand, would inevitably be the product of synergetic studies carried out in various fields of expertise, such as telecommunications, computing, electronics and social sciences. This survey is targeted at those who wish to tackle this difficult discipline and contribute to its growth in such a dynamic scenario. Different conceptions in this model of the Internet of Things are recorded and innovations are checked allowing. What happens is that the science community will also face critical challenges. In depth, the most important among them are discussed.

Gandeva Bayu Satrya, Haftu Tasew Reda, Kim Jin Woo, Philip Tobianto Daely, Soo Young Shin, Seog Chae, "IoT and Public Weather Data Based Monitoring & Control Software Development for Variable Color Temperature LED Street Lights," International Journal on Advanced Science, Engineering and Information Technology, Vol. 7, no. 2, pp 366-372, 2017.

The Light Emitting Diode (LED) is fast becoming the newest technology in street lighting applications. This paper attempts to extend the idea of micro service architecture by integrating the Internet of Things (IoT) concept and LED streetlights so that the implementation process can be flexible and scalable on demand. This paper also explains the integration of SKPlanet, Airkorea and OpenStreetMap LED hardware and Application Program Interface (API) and then shows it to the user via http access via a web browser on a PC or smartphone. In addition, we introduced the control of an internet smart sensor interface that can be used from the administrator or smartphone.

T. Manjula, U. Sreenivasulu, S.JaweedHussain, "A dynamic Raspberry Pi sense HAT multimodality alerting system by using AWS IoT", Indian Journal of Science and Technology, Vol. 9, ISSN 0974 -5645, October 2016.

The key aim of this thesis is to create a multimodality device that can track the values of temperature, humidity, barometric pressure, magnetometer, gyroscope and accelerometer in any application. A wireless Raspberry Pi sense HAT sensor is being used for this proposed device. In this method, all sensor values are obtained and apart from that, the temperature parameter is shown to design an alert/notification. To do this the temperature is over the predefined limit, which will be alerted by submitting a warning email update via text messaging to the user's web account using the Amazon Web Services Internet of Things (AWS IoT) console and reading the monitor data as shown in the form of charts using speech and also downloading the monitoring data logging into a Google spreadsheet using Wi-Fi adaptation. At the same time, all tracking data logs are saved in a Google spreadsheet using the OAuth 2.0 protocol to access the relevant Google Application Program Interface (APIs).

## III. METHODOLOGY

Supply Chain Management (SCM) is the management of the movement of products and resources from the point of production to the point of consumption, including the supply and storing of raw materials, the process and the work for finished goods. In order to maximize the total advantages and to meet the demands of the customer, all the entities are partnered here. SCM's primary goal is to improve end-user product revenue and reduce both inventory and operating expenses. So, we may assume that operational learning and inventory control are essential characteristics of SCM. E-Commerce has been seen to be the electronic commerce of goods and services. SCM is an effective support for solutions for e-Commerce. Radio frequency identification (RFID), which is used to detect the tag connected to the object using electromagnetic fields to store the information, is another module for our work. The passive tag used here absorbs energy close to it from readers. RFID is important for addressing many business needs, such as pallet monitoring, product indication, etc. Contactless communication using a valid reader system is allowed by transmitting the corresponding specific ID via a radio connection. The key protocol used here is the protocol for MQTT. MQTT stands for Telemetry and Transport Message Queue. MQTT is a lightweight application layer protocol that functions on the IP network for the packet switching application using TCP/UDP in the transport layer. MQTT also runs on the AWS cloud for bilateral contact between stuff and users. But here the MQTT

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protocol operates with two control types: Publish and Subscribe. The MQTT protocol server is situated inside the MQTT terminology broker. The broker collects all written and subscribing control messages from publishing devices here to forward them to subscribed devices. The MQTT protocol is introduced using two network technologies in conjunction with this work. The more complex IEEE 802.11 is ideal for fast data speeds and longer data rates.

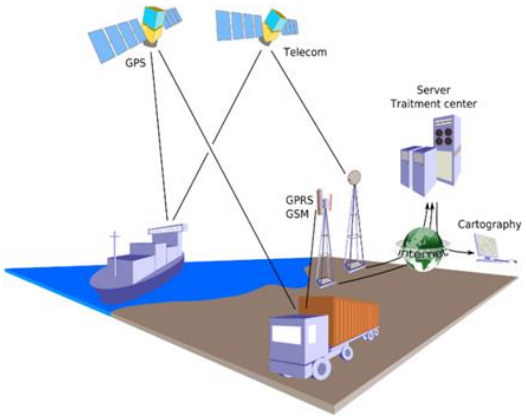


Fig.1. System Architecture for Shipment Tracking

Wireless contact spectrum, because it is ideal for monitoring in areas where power requirement is greater whereas where the GPS coordinates merely have to be retrieved and power requirement is smaller, the job can be achieved by transmitting the data to the cloud and front end by Base Station Trans-receiver (BTS).The overall design was designed using the above modules so that a vehicle with products can be monitored as the GPS coordinates travel between the source and destination to know the proper location of the system for clarity between the businessman and consumers at a given time stamp.

### **A.** *Module for position tracking*

In any sector involving seller, retailer client, we realize that accountability should be preserved when shipping the products so that time and overall expense are used efficiently. This can be accomplished by keeping track of the availability of materials offered. Place monitoring thus joins the image. But detecting a moving object's GPS values involves high numerical computing. Energy, which may in turn be expensive for each part of the supply chain, so that IoT can be applied for the proper use of resources. Basically, an interconnection between the two is designed or set up for implementation to get the GPS coordinates when the sim808 module pins are attached to the Arduino transmitter and receiver pin.

The SIM800 module is a GPS and GSM voice transmission module with low energy consumption data. The Arduino board is used because low processing power is needed and there is more battery life.

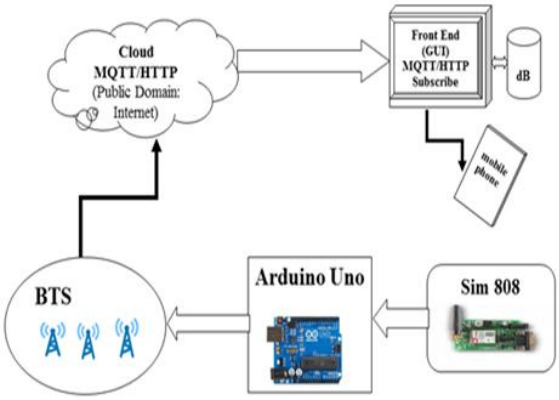


Fig.2. Module for position tracking

As monitoring is cost efficient, it is Built for GPS coordinates only. The information is sent to cloud MQTT/HTTP via BTS. The data can be seen at the front end of the Interface, which is connected to the archive since data can be saved and used in the future as well as in above Fig

### *B. Module for shipment tracking*

For most IoT implementations in the modern world, the planned architecture has been designed with small adjustments to make it suitable for common IoT-based applications. Here, python-based gateway device using the Raspberry Pi framework has been configured to deploy the proposed architecture so that the module can be subscribed to the same subject when the user sends the instruction, and details can be published as the topic's answer and that. The gateway system will fetch the instruction.

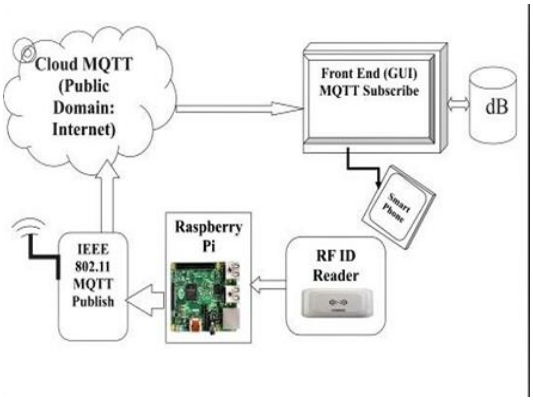


Fig.3.Module for shipment tracking

A high transmission capacity and high data rate are needed here so IEEE802.111 is required. The WLAN network is a good solution for the backbone of the IoT deployment scenario mentioned. Tracking of products is important for the organizer, middle man and client to ensure continuity in the supply chain. The monitoring is conducted in the warehouse during shipping in and out of products with same shipment and scanner ID, respectively, in shipment tracking. The record of transparency can also be preserved with the measurement of average transit time. The simple shipment monitoring model for comparison was explained in Figure

*Findings:*

The performance analysis of each and every sensor was carried out it was inferred which will increase and decreases according to the number of bits transmitted.

*Limitations:*

The scope of this review is by design limited to a cross-section of the literature in this area. As such, it cannot, and does not, attempt to be an examination of the full range of the literature, but a sampling of important and influential works.

*Analysis:*

Comparative device specification review reveals that Raspberry Pi is more suitable for Linux-based RFID shipment monitoring MQTT application platform and Arduino would be more suitable for battery- powered handheld real-time GPS location tracking module.

## IV. CONCLUSION

Using prototyping development tools such as Arduino for SIM808 based location tracking and Raspberry Pi for RFID based shipment tracking, the suggested framework for automation of Supply Chain Management is introduced. Using the software architecture, all the proposed modules are combined to include a robust SCM automation scheme. The two modules built from the scope of this paper are specifically intended for proof of concept. By adopting the same proposed concept, this design will be moved on to the next stage of product growth System architecture of industry-standard embedded frameworks and platforms for cloud analytics. Through creating a data analytics engine tailored for the SCM programme, the analysis work can be further extended.

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