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Monitoring and Tracking Goods and Stuffs While Shipping Containers Using IoT

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ABSTRACT: The Internet of Things (IOT) can be define as an objects that contains a processors, sensors, software and many other technologies that are connected together and can interchange an information with several devices and systems through the internet and communications networks. An IOT devices can share the information or a data that are collected using a sensor or other technologies to an edge device or IOT gateway where the collected data are sent out to be analyzed, these devices can also perform a tasks depends on the information received from other devices. When shipping a container that has a product inside the container, for example an organs or food have to be be kept and sealed carefully and also must be kept in a certain temperature which will keep the product from going bad, and it have to be placed in a safe place to minimize the chance of breaking the product. So, this calls for a continuously monitoring, maintaining-reporting and analysis of various parameters like its temperature, location, humidity and other parameters inside the container throughout the journey.

KEYWORDS: Internet of Things (IoT), Supply Chain, Container monitoring, MQTT.

I. INTRODUCTION

Containers mainly transport the imported and exported commodities. Almost 89% of the world trade is accomplished with the help of containers and they can be used in different means of transportation, including ships and trains [1].Container transportation is characterized by high efficiency, convenience, and safety, and has an important position and role in modern transportation systems. However, Environmental variations that are adverse to the quality may be occurred in the transporting procedure. Therefore, it is important to monitor the status of the container to maintain the quality of transported goods.

The state of fruit, vegetables, dairy products transported in the container should be monitored to guaranty the quality maintenance. The temperature variations and humidity variations may affect the quality of the transported goods.

II. LITERATURE SURVEY

[1] Gowru Devraj, MallamTharun Kumar, Challa Sahith Reddy, Gulla Apoorva Kumar, Kota Shivaji Varma [2022] proposed this paper that the Internet of Things (IoT) is a network of physical devices and objects that connect to provide services to users. New products and services. Containers carrying donated organs should be tightly sealed, kept below a particular temperature, and positioned in a physically safe location in traditional shipping and freight systems to reduce the risk of harm from jerking and unintentional dropping. This paper describes a smart shipping container system that incorporates the Internet of Things (IoT), cloud computing, the Message Queuing Telemetry Transport (MQTT) protocol, and Docker images for shipping container surveillance that is both effective and remote. Keywords: IoT, Shipping Containers, Arduino, DHT11 Sensor, LDR Sensor, MQ2 sensor, LCD, Cloud, GPS.
 working.

[2] Suprava Ranjan Laha, Binod Kumar Pattanayak and Saumendra Pattnaik [2012] proposed this paper that the emergence of the Internet ofThings (IoT) has brought a revolution in global communication network technology. It has acquired many day-to-day applications in healthcare, education, agriculture, etc. As monitoring technology has advanced in recent years, environmental monitoring systems have evolved from essential remote monitoring to an advanced environment monitoring (AEM) system, incorporating Internet of Things (IoT) technology and sophisticated sensor modules.

[3] Yashwanth B, Esther Lallawmawmi, Fabian Lalawmpuia, HC Lalrinhlui [2016] proposed this paper that the Internet of Things (IOT) can be define as an objects that contains a processors, sensors, software and many other technologies that are connected together and can interchange an information with several devices and systems through the internet and communications networks. these devices can also perform a tasks depends on the information received from other devices. So, this calls for a continuously monitoring, maintaining reporting and analysis of various parameters like its temperature, location, humidity and other parameters inside the container throughout the journey. This paper describes a smart shipping container where we implement an IOT, sensors to enhance the security of the container and ensure its reach the owner.

[4] PRAJWAL RATHOD, PREMKUMAR P DHAGE, ROHAN Y, BISNAL ROHIT N CHAVAN [2012] proposed this project that tnternet of Things (IoTs) interconnects physical devices and objects to offer services to improve user's experience. For instance, empowering traditional transport system with IoT will provide greater visibility and traceability to control and monitor objects remotely. In traditional transportation systems, containers carrying groceries and beverages should be sealed carefully, kept below a certain temperature, and should be placed in   aphysical safe place to minimize chances of damaging owing to jerking and accidental falling. During a container's shipping, it continuously monitors temperature, humidity, location, and analysis it on remote cloud server to notify the stakeholders when a certain condition or violation occurs

[5] Anagha Shinde [2017] proposed this paper that this paper discusses effective implementation of IoT to enhance able container security in marine cargo industry. However it is very difficult to control and monitor the container contents. There are various challenges like spoilage, tampering, theft, smuggling of contraband materials even nuclear weapons. Additionally metal containers limits range of RF signals. Various technologies like Satellite/RF/GSM Communication, Cloud Computing, Device Engineering, Last mile connectivity will be utilized for the purpose. This paper reflects our thought process on effective implementation of IoT techniques to enhance the end-to-end traceability and security of containers.

[6] Harshitha K, Suhas M K [2006] proposed this project that hypothetical Internet of Things (IoTs) interconnects genuine contraptions and objects to offer organizations to improve client's knowledge. Lately, as a result of the giant exposure in IoIn standard transportation systems, holders passing gave organs should on to be fixed mindfully, held under a particular temperature, and should be placed in a real protected spot to restrict chances of hurting inferable from shocking and accidental falling. This paper presents a system that uses IoT, Cloud enlisting, MQTT, and Docker compartments for practical and remote controlling and checking of holders. During a compartment's transportation, it continually screens temperature, wetness, region, and sparkle, and examination it on remote cloud server to exhort the accomplices when a particular condition or encroachment occurs

[7] Dr. X. (Xuezhen) Guo, S. (Sander) van Leeuwen MSc, dr. L. (Leo) Lukasse, drs.ing. J. (Joost) Snels (red) [2018] proposed this project that tracking and visualizing the location and condition of high value shipments to prevent loss or damage. Support climate, light or shock sensitive cargo. Tracking high value raw minerals, hazardous materials and custom manufactured parts Track in process shipping containers across the supply chain to prevent spoilage or damage

[8] Ir. S. (Seth) Tromp MTD BA (Wageningen Food & Biobased research), ir. A.(Akshay) Bhoraskar (TNO) [2007] proposed this project that to investigate the feasibility of this innovation, Wageningen Food & Biobased Research (WFBR) and TNO jointly developed a project within the NWO Dinalog financing framework to study IoT applications in the Fruits and Vegetable supply chains. The project includes 4 work packages:

[9] K. Salah, A. Alfalasi, M. Alfalasi, M. Alharmoudi, M. Alzaabi, A. Alzyeodi [2009] proposed this project that internet of Things (IoTs) interconnects physical devices and objects to offer services to enrich user's experience. Recently, due to the tremendous hype in IoT, it is forecasted that by end of 2019 it will generate 19 trillion US dollars revenue. Also, it is estimated that by 2020 up to 50 billion IoT devices will be deployed to offer new services. For instance, empowering traditional transport system with IoT will provide greater visibility and traceability to control and monitor objects remotely. This paper presents a system that uses IoT, Cloud computing, MQTT, and Docker containers for effective and remote controlling and monitoring of containers.

[10] Cleiton Alves dos Santos Joao Simoes, Victor Dolcemascolo, Todd Frazier, Joelle Friedmann, Bertrand Geoffray, Laurent Gonzalez, Jorn Heerulff, David Roff, Stellios Stratidakis, Michael Schroeder and Jaco Voorspuij [2010] proposed this project that The supply chain requirements have changed over the years. Nowadays, supply chain stakeholders place more importance on the need for improved visibility to identify inbound flow of goods to satisfy

higher demands and react to the unexpected. Smart devices unlock the potential to provide accurate real-time data as they are permanently fixed to the transport equipment, provide coverage for the whole journey and are not restricted to reaching physical locations to report events. Monitoring devices capture various measurements which are then transmitted in near real time for further analysis, alerts or general reporting.

III. PROPOSED SYSTEM

The proposed system is an anticipatory model designed for the analysis of suicide rates.Electronic locks equipped with sensors provide additional security and can be remotely controlled to grant   access to authorized personnel. Containers may be equipped with cellular or satellite communication systems to transmit tracking data in real-time, even in remote areas.

Even though the transportation of goods by water can be described as the backbone of trading between countries as it has a high responsibility for the transport of a majority of raw materials, components and products that plays the most important part in the economy, they are rarely a shipping container containing a device that can locate, analyze and report the real-time conditions of the goods inside the container.

Even the few existing containers that provide a monitoring devices, cost are usually expensive and cannot be easily attained and are not user-friendly as they usually need a supervision of a professional. Since we know the hardship, we try to developed a system that can provide a real-time information and notification about the container that are user friendly and less expensive.Develop algorithms for processing and analyzing the collected data. Implement logic for identifying patterns, anomalies, and actionable insights. Utilize techniques like machine learning for predictive maintenance or optimization.
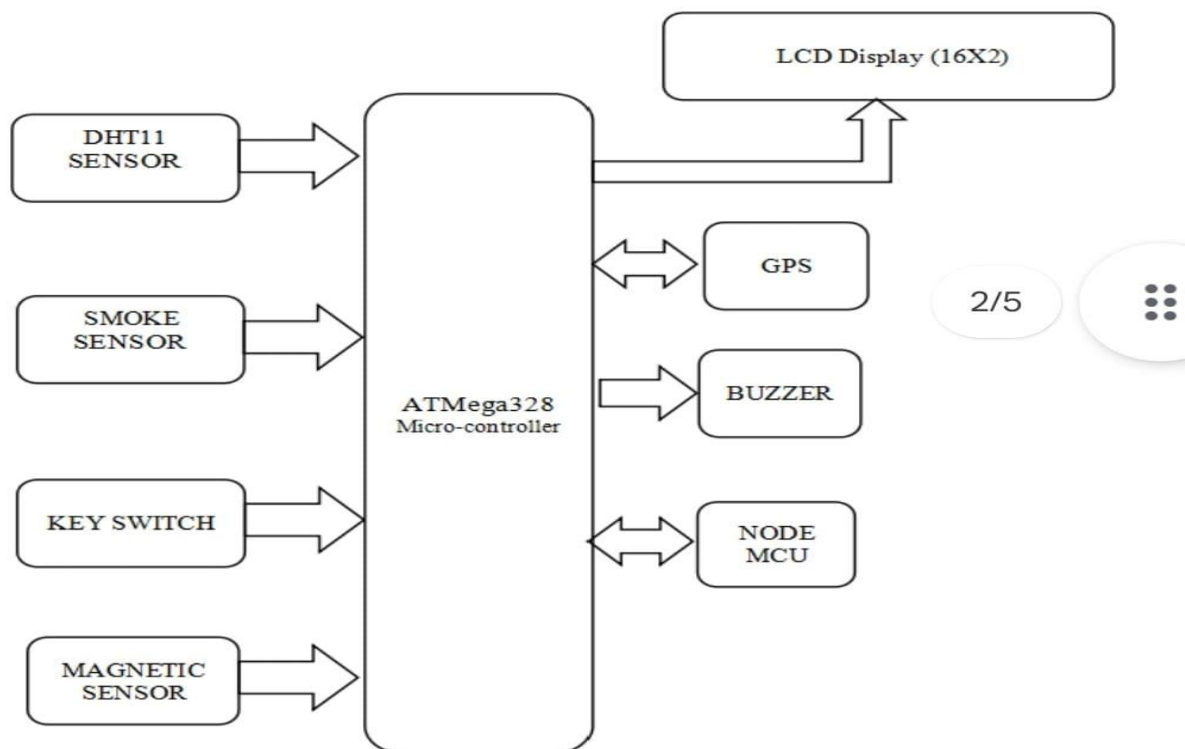

Fig 1: block diagram

After testing the experiment we can see the results from our phone through Blynk app. We can see from the figure that it shows the real-time information about the temperature and humidity of the inside of the container. It will also shows the location and whether there is an intruder or not using the sensors we implemented

IV. RESULT AND DISCUSSION

We had tested the project under different scenarios under different circumstances and it was clearly visible that our project was working with 90% accuracy and the data collected by the sensors were constantly stored in our cloud servers and transmitted

The figure shows some parts of the snapshot of the code. After setting up the Blynk app i.e creating a dashboard and template for all the components that we included in our project we get a code from the Blynk app (the first three line of the code as shown in the figure). We then included this in our main code that we run and compile in the Arduino IDE, and lastly we upload the code on our hardware.
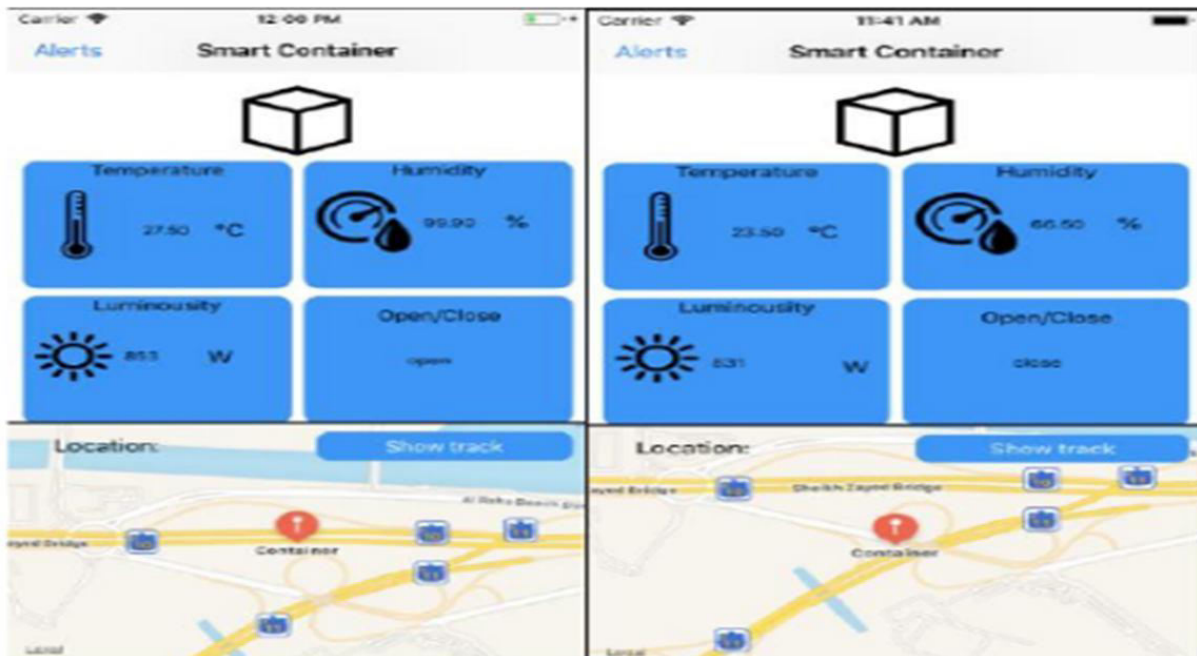

Fig 2: logged data at cloud server

Fig 3: result through blynk

After testing the experiment we can see the results from our phone through Blynk app. We can see from the figure that it shows the real-time information about the temperature and humidity of the inside of the container. It will also shows the location and whether there is an intruder or not using the sensors we implemented.
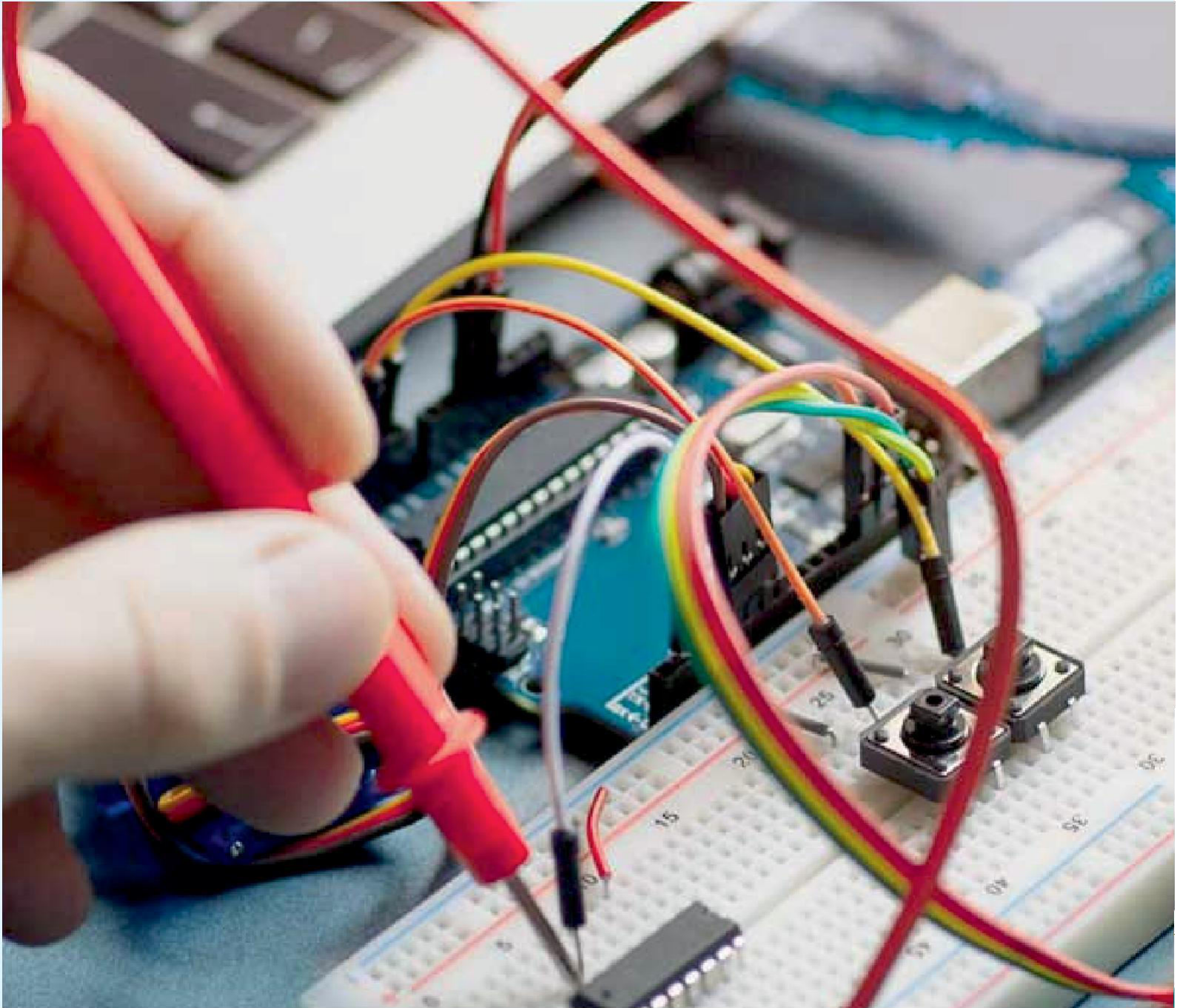
V. CONCLUSION

The integration of IoT technology for monitoring and tracking goods in shipping containers represents a significant advancement in supply chain management. By leveraging IoT devices to gather real-time data on various parameters such as location, temperature, and humidity, companies can ensure the integrity and quality of their shipments throughout the entire journey. This level of visibility enables proactive intervention to address potential issues like spoilage or delays, ultimately enhancing operational efficiency and customer satisfaction.

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