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MEDICINE AUTHENTICITY USING DIGITAL SIGNATURE AND IOT

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Abstract - *Medications are a very important part of every human in the current age. With increasing number of diseases in the world, we need new medications that focus on curing the condition. The basics steps involved in the preparation and shipping of medicines are, research and development, medical trials, certification, production, shipping to warehouses, shipping to medical stores, and finally the sale to a consumer. The fraud of adding fake medicines can happen from the shipping to warehouse phase, where local companies make ineffective medicines and copy the name of the original medicine. These fake medicines are mixed with the originals at the warehouse or at medical stores. There is no way (currently) to know if a medicine is fake or real unless it is tested in a lab by scientists, but only a few samples can be tested for authenticity. we have come up with a tracking system that intends to pass medicines through only the proper channels and a Digital Signature system that records details of every person who has handled the medication from packaging to the local pharmacy. We will tackle the problem of fake medicines entering commercial stream using advanced tracking methods, IoT and cloud services, implement a unique QR code that holds information like batch number, vaccine number, expiry date, contents of the vaccine, etc. to have all information available always, track each batch of shipped vaccine from manufacturer to end user to keep the authentic batches unadulterated and intimate health department authorities if any fraud activities detected.With millions or billions of devices linked together, and the security is most important feature in today's world. Before moving to developing a solution and reference for future research work, we should attempt to know about Internet of Things. The Internet of Things will be an be interface between modules, to name a few: different PCs, Laptops, cell phones, other home gadgets, structures, grounds, vehicles, and urban areas. For security of data, processes are used use sensors to function. The sensors are used in this project to share data to it's the other devices.*

***Key Words*: Medicine, authentication, covid, logistics, Pharmaceuticals, IoT, Blockchain, QR-code.**

1.INTRODUCTION

With increasing number of diseases in the world, we need new medications that focus on curing the condition. The basics steps involved in the preparation and shipping of medicines are research and development, medical trials, certification, production, shipping to warehouses, shipping to medical stores, and finally the sale to a consumer. The fraud of adding fake medicines can happen from the shipping to warehouse phase, where local companies make ineffective medicines and copy the name of the original medicine. These fake medicines are mixed with the originals at the warehouse or at medical stores. There is no way (currently) to know if a medicine is fake or real unless it is tested in a lab by scientists, but only a few samples can be tested for authenticity. we have come up with a tracking system that intends to pass medicines through only the proper channels and a Digital Signature system that records details of every person who has handled the medication from packaging to the local pharmacy.

The adulteration of the original COVID-19 vaccines is a huge threat to the consumers and the pharmaceutical companies developing these vaccines. Tackle the problem of fake medicines entering commercial stream using advanced tracking methods with IoT and cloud services. Implement a unique QR code using adler32 that holds information like batch number, vaccine number, expiry date, contents of the vaccine, etc. to have all information available always. Track each batch of shipped vaccine from manufacturer to end user to keep the authentic batches unadulterated and intimate health department authorities if any fraud activities detected.

1.1 Aim

To detect fake medicines and their addition to the medicine transport stream in transit or at destination and verify its authenticity.

1.2 Objectives

- Tackle the problem of fake medicines entering commercial stream using advanced tracking methods with IoT and cloud services.
- Implement a unique QR code using adler32 that holds information like batch number, vaccine number, expiry date, contents of the vaccine, etc. to have all information available always.
- Track each batch of shipped vaccine from manufacturer to end user to keep the authentic batches unadulterated and intimate health department authorities if any fraud activities detected.

1.3 Applications

This system we have designed can be used by pharmaceutical companies for their logistics division to track, review, and ensure the authenticity of the medicines. This can also be used by pharmacies to ensure that their orders are on path and have not been disturbed. The QR code system will allow them to verify its authenticity.

- Pharmaceutical Companies - Helpful to them as it prevents the trust of consumers on their company.
- Law enforcement agencies - Helpful to them as they can get immediate alert at the point of some illegal activity.
- Medical emergency enforcement - They can get immediate access to the fake medicine and stop it from entering the market.
- Pharmacies - They can be sure of the authenticity of the medicine that they sell.
- Consumers - They can be sure that the medicine that they are buying is real and not fake.

2. LITERATURE SURVEY

In this section, various solutions to authenticate medicines is discussed. Several papers have been published on the need for medicine authentication in current situation. These papers are summarized below:

2.1 The regulation model of pharmaceutical logistics based on the supervision on flow [1]
Medicine logistics affects the operation of medical system. This article writes about the input and output thought of economics, the cybernetics, and the logistics in a new direction.
In this paper, they creatively propose that humans can detect the fake medicine embedded in circulation sphere of medicine by monitoring the differential flow in the distribution of medicine.

2.2 Covid-19 Antibody Test/Vaccination Certification: There's an App for That [2]
With Coronavirus Pandemic, a COVID-19 `Immunity Passport' is the only way to enable individuals to go back to work. In this paper, they address the problems involved in providing tamperproof certification for tests of vaccinations. Methods includes – developing a mobile phone app and decentralized server architecture that facilitates verification of test results. The app along with decentralized server architecture offers a proof of concept that is scalable, applicable, and is waiting in the wings for the biological issues.

2.3 Secured Block-Chain based Communication Scheme for Connected Vehicles [3]
In this paper, they use RFID, Camera, GSM for GPRS. For network connectivity LAN, WAN, MAN is used as a gateway. Data is collected from data centre. General microtransaction scheme uses blockchain.

2.4 A study on the public health and socioeconomic impact of substandard and falsified medical products [4]
The presence of substandard, falsified medicines and their use by patients threatens to ruin the progress towards attaining the Sustainable Development Goals. In this paper they talk about how, such products are of poor quality, ineffective and threaten the health of those that take them. The problem of falsified medical products continues to increase, as globalized manufacturing and distribution systems is growing more complex.

3. METHODOLOGY

Our system approaches the above-described problem with two major modules, a desktop application, and a mobile application. The desktop application will be used by the pharmaceutical companies and the manufacturers to keep track of medicine delivery and other logistics like fire, temperature, impact status. the mobile application will be used by medical store owners and common man to scan the QR code on the packages and verify medicine authenticity.
The desktop interface allows the pharmaceutical company to update information about every batch of medication that has been manufactured and can see the points where the QR code has been scanned to see if it is on the right path. Since there is live GPS tracking, in case the shipment has halted for a long time, the company can be notified, and the logistic division can be contacted immediately to know what is happening.

The android application allows the logistics division to scan the QR code to update its arrival and departures. It also allows the user to find and match the exact batch number and other details to know more about the medication that they are consuming.

Truck tracking module functionalities:

- QR generator Admin desktop application to generate / print and maintain parcel details
- Android app for QR scanner
- Android app to update cloud data base using web API
- Block chain implementation to store parcel location and decentralized

IOT model

- Sensor communication modules
  1. Temperature sensor
  2. Fire sensor
  3. Impact sensor

- Accessing MQTT broker from IoT model
- Data push to MQTT service
- Web based client application for parcel tracking

- Geo coding and Google map integration within web application to find approximate address and map marker

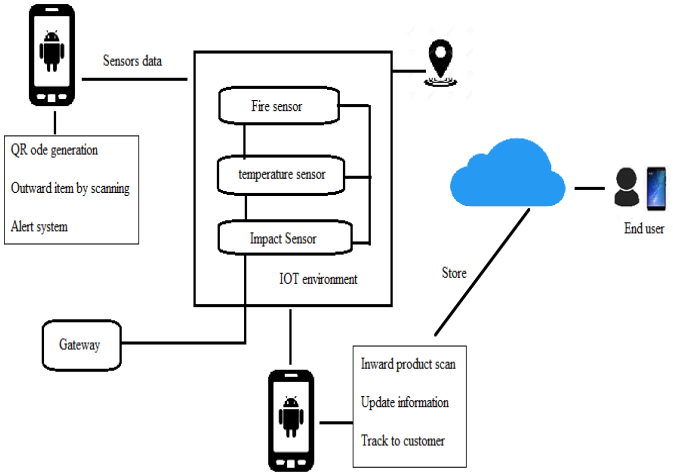

Fig- 1 System Architecture

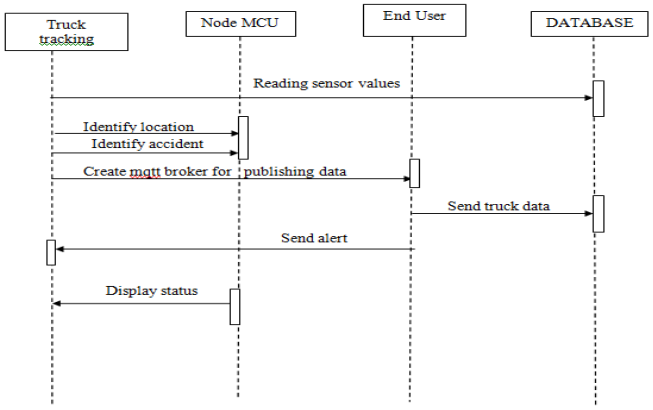

Fig -2: Sequence Diagram

4. DESIGN AND IMPLEMENTATION

We have a desktop application and a mobile application. The desktop application generates the QR code and keeps track of the logistics. The mobile application scans this QR code, and this data can be posted to the database with the option inward or outward. Inward means the package is scanned on arrival to the destination. Outward means the package is scanned before sending it to the next hub. The hub refers to the location where it is being scanned. This allows us to keep track of all the locations the package has been through and any deviation between these hubs can be tracked. The IoT part helps with the tracking of packages between hubs. The GPS module (using GPGGA), fire sensor, and impact sensor are coupled with the Node MCU which will publish the data containing the longitude, latitude, fire status and impact status to the Hive MQTT server. We subscribe to this data from our desktop application. Using this live data, we can track the logistics of the vehicle and alert the user when required. The desktop application is designed to handle attacks on the data in the database.

4.1 Mobile application flow

The application requires camera and location permissions. Once the permissions are granted, using the Google API Client, we get the location of that device. The user will have to register providing the necessary details and then will be able to login. Once they successfully logins in they will be able to scan the QR code. The user can select the option: inward or outward and post to the database accordingly.

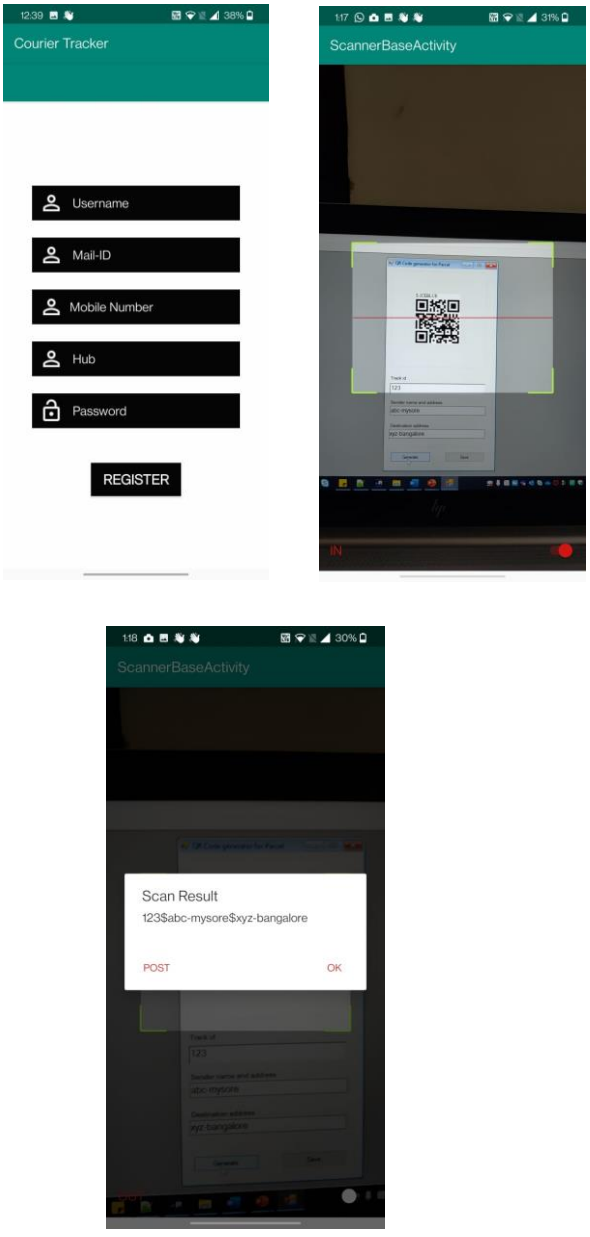

Fig -3: Flow of Mobile application

4.2 Desktop application flow

The application uses Spire. Barcode API to generate the QR code based on the text provided. This generated QR code can be saved to the system. For the live tracking and logistics, we use GPS module, fire, and impact sensors. These hardware components are coupled with Node MCU which connects with our cloud service where we publish the data from all these components in a queue to a specific topic. The cloud service being used is Hive MQTT which is an enterprise broker to fast, efficient, and reliable movement of data to and from connected IoT devices. All the data from the queue will be subscribed in the desktop application. Once the data is received, they are compared to a threshold which if crossed the application alerts the user.

To manage data security, whenever the data is inserted into the database, we calculate checksum for the entire data using Adler-32. The entire data along with checksum is duplicated into another database. Thus, whenever any hacker tries to manipulate the data in the database, the checksum is calculated and compared with the redundant table. If any mismatch is found, original data would be recovered.

Fig -2 : Desktop application Logistics Screen

Fig-5: QR Code generation screen

5. CONCLUSIONS

The proposed system is beneficial for monitoring, tracking, and tracing medicine by using GPS module. Reduces risk regarding fraud or fake medicines by Real time Monitoring by using QR code or Barcode details on medicines in carrier for purpose security. This system helps the clients with the capacity to access the information of item, service, supplier, and carrier by providing customers with the provenance of data and cargo route.

In future, the system can be enhanced in following ways:

- The shipped products from commercial stores can be tracked and traced using IOT and block chain technology.
- It can be further applied in monitoring all the stages of drug manufacturing and supply to the shops

6. REFERENCES

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BIOGRAPHIES

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