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# Internet of Things in the Setting of COVID-19 In E-Commerce: Defining and Implementing an Appropriate Framework

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**ABSTRACT**
The Internet of Things (IoT) is expected to have a significant impact during the pandemic. Individuals are using IoT for educational purposes (as students and trainers), office work, banking, and medical jobs during the pandemic, according to the (COVID-19) survey. Individuals who have used IoT services during pandemic situations have found that it allows them to maintain a close physical distance from illness. On the other hand, individuals face the main challenge of using IoT as it causes social isolation and limits the human touch. An anonymous survey and an immediate randomized process were used to collect data. This paper aims to provide a framework for supermarkets. The proposed approach focuses on different retail operations using Internet of Things technology. The process of collecting and organizing the various store operations becomes noticeably faster once items are connected to the platform. The obtained results show the feasibility of the proposed framework.

***Keywords:*** *E-commerce, IOT, COVID-19, data sharing, Internet of Things, Pandemic-Management.*

## 1. INTRODUCTION

Since its discovery in late December 2019, COVID-19 has been confirmed in more than 14.5 million individuals in 185 countries **[1].** Nearly 95,000 people have died in these cases, with a mortality rate of 4.2%. On March 11, 2020, the World Health Organization declared the coronavirus pandemic unusual. Unfortunately, there is no effective treatment or immunization at the moment. It is likely that it will take at least a year to develop an effective vaccine, as the source of the virus is still unknown **[2].** In **[3],** authors posted that the only option for the world now is to stop the spread of the coronavirus by implementing precautions such as social isolation, hand washing and face masks. On the other hand, early detection (or prediction) and monitoring of new cases may help reduce the spread of disease. For example, big data, cloud and fog technologies, and remote monitoring technologies such as mobile health, telemedicine, and real-time patient tracking are all examples. With so many alternatives, incentives, and information available, today's consumer is puzzled about which product to purchase **[4].** However, the globe is suffering at the moment. COVID-19 is a newly identified coronavirus that has rapidly spread over the world. Infected individuals spread the virus by coughing, sneezing, or conversation, or you may contract it by contacting a surface or item that contains the virus and then touching your mouth, nose, or eyes. As a result, an intelligent supermarket streamlines the purchasing process by offering the best pricing and alerting consumers of their purchases **[5].** Additionally, locating the appropriate item in the store may be challenging, aggravating, and time-consuming. It is a disappointment to get to the desired department and discover that the required item is unavailable or unavailable. Additionally, many foods need temperature regulation and storage in appropriate air conditions, which might be harsh and demanding during shipping **[6].** IoT applications are available in a variety of sizes and forms. Only a few applications are being developed, using complicated IoT systems as the driving technology. In the Internet of Things, every human behavior may be leveraged. Supermarkets have long lineups during the peak shopping season. Customers and mall employees both lose time due to long queues [7].

The authors mentioned in [8] that the Internet of Things (IoT) is a collection of technologies that allow individuals to communicate with one another and with their environment [8]. Kevin Ashton suggested it in 1999 after discovering that real-world objects may link to the Internet through sensors. This allows for collecting RFID data in online commerce to monitor different

 

commodities and things for sale without the need for human interaction. Existing IoT applications may link and combine a variety of devices, gadgets, and sensors. Although coordination systems and computers have been used to monitor and manage items for many years, the Internet of Things is still considered a novel notion.

The Internet of Devices (IoT) is a novel idea centered on things that can connect, such as RFID tags, sensors, and actuators [8]. IoT links unknown physical pieces that use IPv6 addressing protocols to gather and deliver data. The project's primary goal is to enhance the shopping experience. As a result, this system will outperform others [9]. The smart supermarket comprises intelligent equipment linked to the Internet of Things (IoT) technology, which was first developed by Kevin Ashton in 1998 and has continued to grow and demonstrate its efficiency in e-commerce. Smart gadgets are at the heart of the Internet of Things. An intelligent shop may be used to improve retail operations without requiring consumer contact or interruption, such as selecting the most excellent deals, comprehending precise product information, or learning about what's available. Smart supermarkets may provide various services, including security and remote management. IoT Analytics' continued coverage of the Internet of Things includes an examination of the implications of IoT Q1/2020 and the Covid-19 scenario [10]. Additionally, evaluate how they may help m-commerce suppliers achieve a competitive edge. We offer research paths for models that assist merchants in upgrading mobile applications to fulfil the demands of subsequent generations. The critical experiences provided by programs may become more significant in the job. App producers are interested in learning how to attract, retain, and encourage users to suggest their apps to others [11]. Correlation analysis was utilized in conjunction with an adaptation of Cattell's questionnaire. This study used a questionnaire to ascertain how internet consumers behave throughout a transaction. We surveyed online shoppers in the 10 fastest growing e-commerce areas. To investigate online consumers' buying behaviour, the scientific contribution presents an analytical framework for finding the most critical factors influencing their purchasing choices and detecting significant trends and changes over time. The study discovered shifts in online consumer purchasing behaviour during the COVID-19 outbreak. Consumer knowledge and experience are becoming more valuable. Online customers have gained expertise, and their purchasing habits have evolved. Throughout the epidemic, the features of online client buying behaviour grew. Online purchases of goods and services have proven to be more time-demanding. The study discovered shifts in online consumer purchasing behaviour during the COVID-19 outbreak. Consumer knowledge and experience are becoming more valuable. Online customers have gained expertise, and their purchasing habits have evolved. Throughout the epidemic, the features of online client buying behaviour grew. Purchasing goods and services online demands individuals to make rapid judgments [12].

This paper aims to contribute to the purchasing process by describing the customer's attitude to different sensors, equipment, and screens. Thus, it may be an excellent answer to help clients at this time of widespread concern about a new disease. COVID-19.

This article is divided into the following: We'll go through similar work in Section 2. Our proposed system appears in Section 3. Section 4 discusses our approach, which includes an explanation of the gate and how our software works. Then, in Section 5, we'll discuss some implementation details and results. Finally, in the last part, Section 6, we end our efforts.

## 2. METHODOLOGY

### 2.1 The proposed system

The proposed system consists of a smart card with a UHF RFID reader, a CPU, an LCD touch screen, a ZigBee adapter, and a weight sensor. The RFID reader of each smart car enables it to scan any objects indicated by this sensor quickly. The microcontroller plays an essential role at this point, complemented by an LCD touch screen that serves as a user interface for managing all this data. We chose ZigBee (data exchange) technology because it's low-power, inexpensive, and works well when establishing a solid connection to the server. We can't forget the weighted scanner installed on every smart cart to weigh things. In addition, an RFID scanner is placed just before the exit door for security reasons to identify any attempted theft. Security and privacy are our primary considerations in this endeavor. In addition, we aim to satisfy customers by implementing our system concept, which automatically checks item quality and quantity. In addition, the proposed technology provides additional instructions for the visual customer to interact independently with their purchase desires. Improves and simplifies the shopping experience; RFID technology and microcontrollers may significantly support the system method. We aim to develop an intelligent supermarket that responds to the customer's needs and helps him calculate the total cost of things purchased while also simplifying the cashier's task. RFID tags, rather than barcodes like those found in most grocery stores, will be used to identify each item in this initiative. Equipment must be effectively integrated and controlled to provide the proper mechanism (**See Figure 1**).

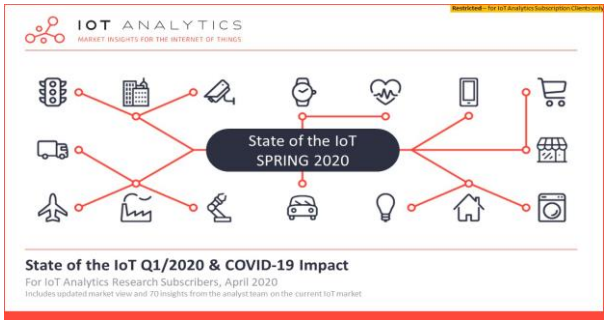


**Figure 1.** Q1/2020 State of IoT & Covid-19 Impact Report

### 2.2 Healthcare iot for virus pandemic management

To use the IoT to combat a global viral pandemic, a specific ecosystem of hardware, software, and regulations must be in place. Based on the study results, this section identifies the components of the healthcare ecosystem. A customized set of well-integrated components is created using the Internet of Things to tackle the pandemic. These components combine to create a hostile environment for the transmission of the virus. Cost savings, improved control, rapid diagnosis and improved treatment are advantages of using IoT to combat a pandemic like COVID-19. Several research contributions indicate that an ecosystem of this type contains the following major components.

### 2.3 Sensor Hardware

Hardware sensors play a critical role in the H-IoT system. This hardware serves as a significant data source for the purpose and objectives of the IoT deployment. Sensor gear for a viral pandemic may include wearable devices such as BANs or cellphones equipped with sensors such as GPS, accelerometers, and cameras. Sensors advocated using IoT devices to monitor the pandemic spread and instantly report instances. If the hardware design was user-friendly, the deployed intelligent machines might be used on flights, airports, and humans. A network of computers and telephones is necessary to aid in pandemic management while preserving social distance. Rapid screening from a safe space has accelerated the development of such low-cost technologies. A frequent strategy is to use existing smartphone technology as low-cost sensor gear. The smartphone's accelerometer, microphone, camera, and temperature sensors are used to detect early COVID-19 symptoms. Geolocation sensors and drone technologies are being used to identify and diagnose COVID-19. Mohammed et al. [25] demonstrated a thermal imaging Internet of Things drone approach for COVID-19 detection.

### 2.4 Data extraction and analysis

Sensor infrastructure is crucial in IoT organizations because it offers vital data that aids in issue solving. Researchers need data on infection, patient condition, and location to deal with epidemics successfully. On the other side, increasing the number of sensors results in increased data gathering, which necessitates using data filters and sophisticated data management. Machine learning and applications of artificial intelligence, in general, are gaining traction in data analysis and decision-making. ML approach was used to train thermal images for negative and positive COVID-19 tests. The authors **[13]** mentioned artificial intelligence, machine learning, and the Internet of Things as potential technology combinations to avoid a viral pandemic. Using CT scans and X-rays, deep learning, a component of artificial intelligence, may reliably diagnose COVID-19 infection. The combination of trend analysis and machine learning is another essential data analysis technique used to fight the coronavirus. COVID -Sens uses social media data and machine learning to monitor the spread of the virus. Based on user comments on social media, the application may filter new vital information for the government and the general public. Additionally, we may use the Internet of Things virtual sensor nodes and machine learning to bridge data gaps and predict infection rates.

### 2.5 The proposed approach: A case study of a smart supermarket

A smart supermarket is a living space that uses Internet of Things technology to compare items to enhance purchasing decisions and perform multiple tasks simultaneously without consumer participation. This whole process is possible due to the RFID sensor at the point of sale, which detects any items and cards that our customer has and allows him to learn more about them with an approach to his desire. Among the services offered by the intelligent store, the following are some of the valuable ones that help in simplifying the buying process and directing the consumer to the ideal shopping area: To start, on hot days, the thermal sensor detects the increase in temperature and provides a signal to the system; As a result, the air conditioner immediately starts up and begins to cool the weather. Second, using the example of some vegetables that wilt over time and need a little water to be vibrant, our intelligent system intervenes by activating a garden sprinkler that automatically wets those plants with a mist of water. In addition, our approach includes Doors01 (device, sensor) that are installed on entry doors and screen each incoming customer for security purposes, as well as Doors02 (machine, sensor) installed on exit doors and detect the possibility of exiting unpaid items (attempted theft). In addition,

there is ingenious technology. When objects are placed above the shelf and are too high for the customer to reach, the automatic panel pushes the selected item into your hand; This makes every item more accessible and easier to grab. Another critical system sensor identifies any shortage of things in the store (on the shelves). It sends a message to the inventory control unit with the names of products and locations for replacement. And of course, the intelligent cart has a simple code that calculates the total price of all products and shows it on a small screen wherever every object is RFID-tagged. Every innovative office vendor is pre-configured and equipped with an IoT detection sensor.

### 2.6 IoT SOLUTIONS In E-commerce

Solutions Along with nationwide lockdown and confinement of vital personnel, distance is essential in avoiding transmission of the virus. Advances in the Internet of Things have been supported by new IoT technology that integrates social space into epidemic control. Modern IoT systems increasingly warn residents to avoid high-risk areas through artificial intelligence and social media posts. People like to broadcast news and ideas on social media when a hack occurs, including sites and statistics. A machine learning algorithm trained on this data may provide vital social distance statistics to affected locations. When the user is close to a particularly high-risk area, the warning data can be paired with information from the geolocation sensors built into their smartphone. Drones are used in Spain and other countries to urge residents to stay home and thermal imaging. Drones may collect information about crowds to help authorities enforce social distancing laws. The data collected here can power intelligent city infrastructure and intelligent transportation systems. Implementing the Internet of Things in the form of elements and infrastructure will speed up this process. In addition, other IoT applications allow intelligent devices to hold remote virtual meetings. It is enforced by using a network of smart devices equipped with applications such as Zoom cloud meetings, Google Interviews, and Microsoft Teams. Smart wearables equipped with sensors to alert users about social isolation are also being investigated. In addition, the intelligent device has additional functions such as thermal screening of personnel close to the user. In general, the recommended device informs the user of social distance violations by providing warnings when people get too close. While the above programs are helpful, they are not without problems. Privacy concerns and social reluctance to share data remain significant obstacles. Privacy concerns arise due to the use of smartphone apps, drones, and ITS infrastructure. Stakeholders always raise concerns about the security and anonymity of the data obtained. Another challenge that IoT related technologies such as artificial intelligence and big data must solve is data accuracy and reliability. This is because managing a global pandemic necessitates using many data sources. Using data from social media is no exception. Wearable e-health devices continue to raise concerns about user safety. The amount of data generated by sensory IoT systems is enormous, and as a result, an appropriate framework is necessary to achieve the desired results from the technology. Intelligent systems are needed to assess and track the spread of a viral pandemic using the available innovative methods to determine and track the space of a viral pandemic using the available data. To develop our approach, the following tasks have been identified and implemented.

- Big IoT data and artificial intelligence: big data analytics and modelling can be used to simulate the spread of the coronavirus in real-time.
- to detect, monitor, track and predict a pandemic. In terms of big data analytics, most of the value in epidemic control is still in the future. The main reason is that the community accepts the data and is willing to share it. The growth of thermal imaging data, location data, and social media feed, among other things, provides an excellent opportunity for data scientists to track virus transmission and provide health management solutions.
- Visual Mapping: Create real-time dashboards that simulate the virus's global spread.
- Create a control panel of this type with an interactive web-based interface. Dashboards are powered by artificial intelligence and various data sources, including location data, social media feeds, and public data— Diagram of the current virus stage.

### 2.7 Implementation

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IoT availability was justified at the higher level of the system network. As shown in this diagram, all IoT devices is configured to remotely connect to an IoT server using a login, a password and, of course, the server's IP address. As shown in Figure 2, the activities

of intelligent IoT devices were used to signal movement, alarm, garage entrance, fan, and smoke alarm. However, they have been used to influence an environment variable to re-enact.


**Figure 2**. Prototype system

## 3. CONCLUSION

COVID-19 has expanded the scope of e-commerce to include new businesses, consumers, and product categories. It has enabled consumers to access various items from the comfort and safety of their homes. It has allowed companies to continue to operate in the face of communication and other restrictions. This paper reviewed the solutions available to create an intelligent supermarket using IoT technology to help customers shop safely and avoid infection. We can confirm that every innovative grocery system based on IoT technology is remarkably effective when a customer-friendly approach is used. We can handle the buying process effectively, which benefits both the consumer and the business owner, increasing economics and profits. Finally, we can mention that smart supermarkets provide various functions such as indoor navigation, food monitoring and express checkout, and connected to the customer's smartphone to provide information efficiently. In addition, each layer of the IoT architecture was reviewed, and design suggestions were made to resolve these concerns. Individuals, governments and medical professionals must be better equipped to deal with epidemics because of the structure to maintain complete social isolation while providing vital resources.

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