ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIV, Issues– II (A) March – April, 2025

OPEN ACCESS Original Research Article

THE GIG ECONOMY AND THE ROLE OF INTERNET OF THINGS (IOT) IN ENHANCING WORKER PRODUCTIVITY, SAFETY AND SUSTAINABILITY

** Mrs. Greenal Frankey Gonsalves,** Mrs. Pradnya Amol Dsouza & *** Mrs. Supriya Sudeep Mhatre*

Assistant Professors at Annasaheb vartak college Vasai

Abstract:

The gig economy has revolutionized the global workforce, offering flexibility and autonomy to workers while enabling businesses to access on-demand talent. However, challenges such as inconsistent productivity, safety concerns, and environmental sustainability persist. The Internet of Things (IoT) has emerged as a transformative technology capable of addressing these challenges by enhancing worker productivity, improving safety, and promoting sustainable practices. This paper explores the intersection of the gig economy and IoT, focusing on how IoT-enabled devices and systems can empower gig workers, ensure safety, and contribute to environmental sustainability. Key areas of focus include IoT applications in task optimization, real-time monitoring, safety enhancements, and sustainable resource management. The paper concludes with recommendations for leveraging IoT to create a more productive, safe, and sustainable gig economy.

Key Words: *Gig Economy, Internet of Things (IoT), Challenges in gig Economy, Productivity, Safety, Sustainability.*

Introduction:

The gig economy, characterized by short-term, flexible, and freelance work arrangements, has grown exponentially in recent years. Enabled by digital platforms, gig workers now constitute a significant portion of the global workforce. In the gig economy, gig Workers (also known as independent contractors or freelancers) have the flexibility to choose when, where and how much they want to work. Popular gig economy activities include food delivery services, freelance work and freelance digital work.

Gig workers are classified into platform and non-platform-based workers.

1. Platform workers are those whose work is based on online software apps or digital platforms.
2. Non-platform gig workers are generally casual wage workers in the conventional sectors, working part-time or full time.

A report by NITI Aayog projected that the gig workforce in India could grow to 23.5 million workers by 2029-30. The report highlighted that the gig economy could contribute 1.25% of India GDP by 2030.

The term Internet of Things was coined by Kevin Ashton, a British technology pioneer, in 1999. IoT refers to a network of physical objects that are embedded with sensors, actuators, software's and other technologies to connect and exchange data with other devices and systems over the internet. These devices range from everyday household items to sophisticated industrial tools. The primary goal of IoT is to enable seamless communication and automation between devices, improving efficiency, convenience and decision making.

Devices are controlled and directed from distant locations; they can also be conditioned to perform tasks on their own with the help of IoT. For example, Tesla

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIV, Issues– II (A) March – April, 2025

OPEN ACCESS Original Research Article

cars are essentially smart vehicles that leverage IoT to enhance functionality, safety and user experience.

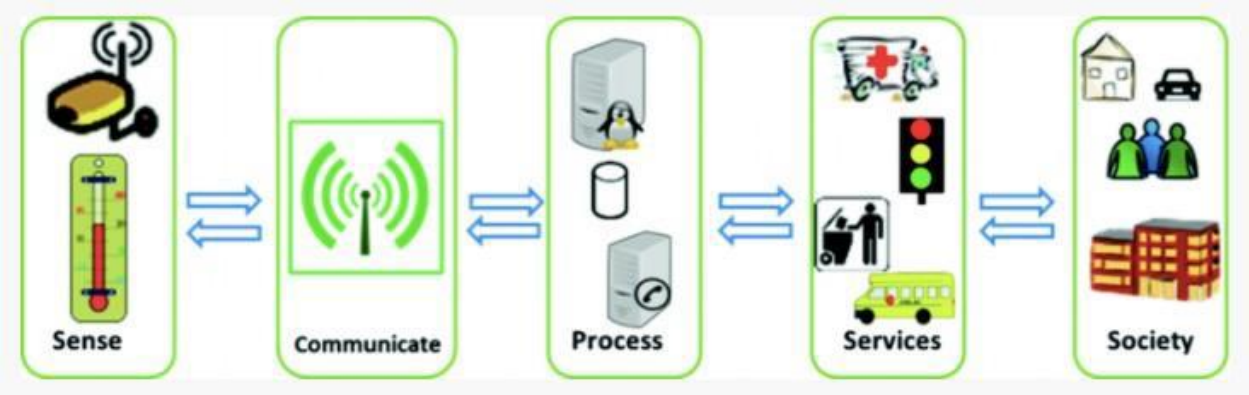

FIGURE 1: IoT configuration

India is experiencing a significant surge in IoT (Internet of Things) usage, driven by government initiatives like "Digital India" and "Smart Cities," leading to rapid adoption across sectors like healthcare, agriculture, and manufacturing, with estimates suggesting India could have around 500 million IoT connections by 2025; this growth is fueled by the demand for smarter solutions and increased operational efficiency across industries.

Literature Review:

By integrating IoT into gig work, businesses and workers can benefit from enhanced connectivity, automation, and data-driven decision-making. This paper explores the role of IoT in enhancing gig worker productivity, safety, and sustainability, emphasizing its potential to transform the gig economy. The Internet of Things (IoT) enables real-time data exchange, which is essential for improving various processes. Despite technological advancements, significant challenges persist in ensuring worker safety and productivity within established standards. Effective monitoring is critical to maintaining worker well-being and safety. IoT provides a data-driven solution through real-time tagging and movement tracking on a cloud platform. The aim of this paper is to illustrate how IoT can enhance worker safety and productivity, improve working conditions, and foster fair performance appraisal practices, while also contributing to the sustainability of the gig economy.

IoT uses accurate sensors to identify hazards, provide timely warnings, and facilitate rescue operations, enhancing safety and boosting productivity through vital sign monitoring and personalized suggestions.

Additionally, it will explore how IoT optimizes resource usage, reducing waste and environmental impact, ultimately improving working conditions in various sectors, including the gig economy.

Challenges in Gig Economy:

1. **Productivity Variability:** Inconsistent workloads and lack of real-time communication can lead to inefficiencies. Gig workers may experience periods of high demand followed by dry spells, making it difficult to maintain consistent productivity. Gig workers often struggle with inefficient scheduling, last-minute cancellation and unpredictable workloads. Delivery drivers waste time due to poor route planning, traffic or incorrect addresses. Ride hailing and delivery drivers lose income when their vehicles break down.

I. **Technological solutions for Increasing Productivity:**

IoT (Internet of Things) devices can significantly enhance the productivity of gig workers by automating tasks, improving

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIV, Issues– II (A) March – April, 2025

OPEN ACCESS Original Research Article

efficiency, and providing real-time data. Here are several ways IoT devices can boost productivity for gig workers:

a. **Connected Vehicles:** The Internet of Things (IoT) is rapidly altering how people live and interact with technology while also reshaping several industries. This technology has also connected vehicles to the internet, making them a new rage in the automobile industry. It enables vehicles to communicate with each other, with infrastructure and sensors to improve safety, efficiency and convenience. It connects to the internet with the help of a Wireless Local Area Network (WLAN) and transmits data to other devices inside and outside the vehicle.

These systems include features like GPS, vehicle-to-vehicle (V2V) connectivity which allows vehicles to share information about their speed, direction and location to prevent collision.

For gig workers in delivery or transportation, IoT-enabled vehicles can optimize routes, monitor fuel efficiency, and provide maintenance alerts, reducing downtime. It also connects vehicles to cloud-based services for real-time data exchange, enabling features like remote diagnostics and software updates.

Use Case:

A gig worker delivering packages for Amazon Flex uses a connected electric van. The vehicle's navigation system calculates the most efficient route based on real-time traffic data, while the onboard diagnostics monitor battery levels and suggest nearby charging stations. The worker receives notifications about upcoming gigs and can accept them directly through the vehicle's interface. At the end of the day, the system provides a detailed report of earnings, mileage, and expenses.

b. **Drones and Robotics:** For gigs involving inspections or deliveries, drones and IoT-enabled robots can perform tasks faster and more accurately. It's an emerging technology that combines unmanned aerial vehicles (UAVs) with IoT connectivity to enable efficient, automated and real time delivery of goods.

Drones equipped with IoT sensors, GPS, cameras and communication modules can collect and transmit real time data during flight. Sensors monitor parameters like altitude, speed, battery life and environmental conditions. Challenges such as poor infrastructure, traffic jams, and geographic barriers, often affect traditional delivery methods. Drones bypass traffic and deliver goods directly to the destination, reducing delivery time.

Unmanned drones can deliver to remote or hard to reach areas where traditional logistics are challenging. They can service rural or remote areas as efficiently as urban ones, breaking down accessibility barriers

c. **Challenges**:

1. Initial Cost: High upfront cost of purchasing or upgrading to connected vehicles.

2. Data Privacy and Security: Ensuring the security of personal and operational data.

3. Connectivity Requirements: Dependence on reliable internet and 5G networks.

4. Learning Curve: Gig workers may need training to fully utilize connected vehicle features.

2. **Safety Concerns:** Many gig workers, especially those in delivery and ride-hailing services, spend a significant amount of time on the road, increasing their risk of accidents. Long working hours and exposure to pollution can lead to health issues. Additionally, the lack of access to healthcare benefits exacerbates these risks. Gig workers often

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIV, Issues– II (A) March – April, 2025

OPEN ACCESS Original Research Article

work alone, which can lead to feelings of isolation and lack of support. Lastly the gig workers can pose serious cybersecurity risks for the company by remotely accessing sensitive corporate data on their own devices.

I. Technological solutions for safety:

The Internet of Things (IoT) has the potential to significantly improve the safety and working conditions of gig workers in India. By leveraging IoT devices and technologies, various safety concerns can be addressed more effectively. Here are some ways IoT can help:

a. Wearable Safety Devices

IoT wearables (e.g., smartwatches or panic buttons) can be provided to gig workers to monitor their health (e.g., heart rate, fatigue) and send alerts in case of accidents or health issues. It ensures quick medical assistance in case of accidents or health emergencies and reduces risks for workers in physically demanding roles.

A panic button: It is an electronic device designed to assist in alerting somebody in emergency situations where a threat to persons or property exists. Panic buttons, crucial for enhancing personal safety and providing immediate assistance in emergencies. When the user feels threatened or is in danger, they can press the panic button to send an immediate alert to predefined contacts (e.g. family, friends or emergency services).

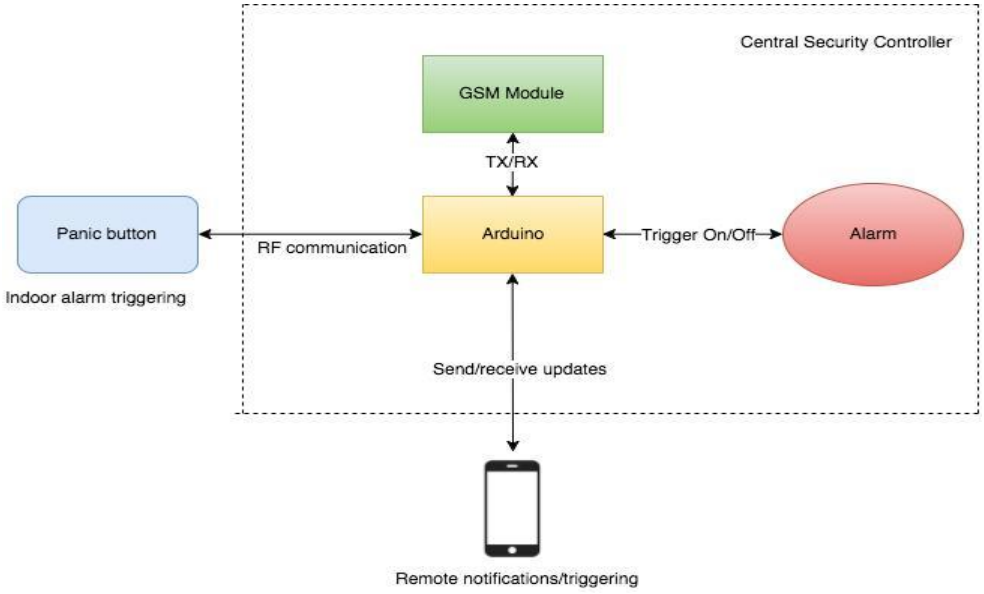

FIGURE 2: Block diagram of panic button

b. Monitoring Working Conditions

IoT sensors can monitor environmental conditions (e.g., temperature, air quality) for gig workers operating in hazardous environments, such as warehouses or construction sites. Since gig workers often spend long hours on the road or in varying environments, poor air quality can impact their health and productivity.

Rideshare drivers spend hours in cars, where pollutants like CO (carbon monoxide), NO2 (nitrogen dioxide) can accumulate. A portable in-air quality sensor can alert drivers to roll down windows or use air filtration.

Motorcycle delivery riders are exposed to exhaust fumes, road dust and wildfire smoke, increasing respiratory risks. Wearable sensors can track real time ozone, CO levels, suggesting safer routes.

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIV, Issues– II (A) March – April, 2025

OPEN ACCESS Original Research Article

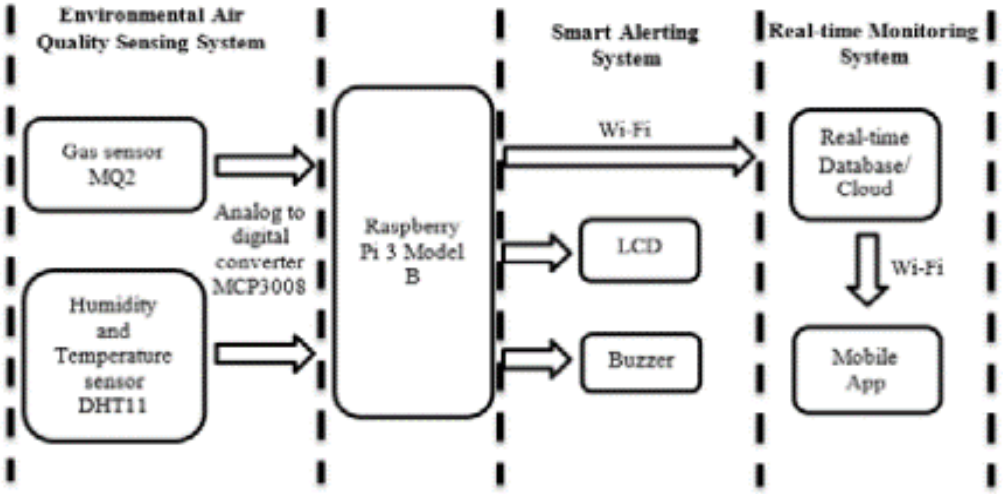

FIGURE3: Block diagram of the real-time IoT-based environmental monitoring system for air quality

c. Steps to Implement IoT for Gig Worker Safety in India

1. **Partnerships:** Gig economy platforms can partner with IoT providers to offer affordable and scalable solutions.
2. **Government Support:** The Indian government can incentivize IoT adoption through subsidies or policies promoting worker safety.
3. **Pilot Programs:** Start with pilot programs in high-risk sectors (e.g., delivery or ride-hailing) to test IoT solutions.
4. **Worker Education:** Train gig workers on using IoT devices and understanding their safety features.
5. **Data Security:** Implement robust data encryption and privacy measures to protect worker information.

3. **Sustainability Issues:** The gig economy often relies on resource-intensive practices, contributing to environmental degradation. It relies heavily on transportation, especially for ride-hailing and delivery services. This has led to a surge in the number of vehicles on the road, contributing to higher carbon emissions and air pollution. The rise in vehicular emissions from gig economy activities contributes to poor air quality, particularly in cities like Delhi, Mumbai, and Bangalore, which already face severe air pollution. The food delivery sector generates massive amounts of single-use plastic waste, including containers, cutlery, and packaging materials. Online shopping platforms often use excessive packaging, including plastic wraps and bubble wraps, contributing to plastic pollution. India's waste management systems are often inadequate to handle the volume of plastic waste generated by gig economy activities. Gig economy platforms rely on energy-intensive data centers and digital infrastructure, which contribute to carbon emissions.

I. <u>Technological solution for Sustainability:</u>

a. smart packaging: Sustainability is a major concern in the packaging industry, with growing pressure to reduce waste and minimize environmental impact and reducing the overall carbon footprint. Smart IoT packaging for sustainability is an innovative approach that integrates advanced technologies into packaging systems to enhance environmental sustainability, improve supply chain efficiency and reduce waste. By leveraging IoT-enabled sensors systems track crucial parameters like

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIV, Issues– II (A) March – April, 2025

OPEN ACCESS Original Research Article

temperature, humidity, and location, ensuring optimal product protection while minimizing environmental impact.

Smart packaging powered by IoT technology enables end-to-end visibility across the supply chain, from production to consumption. Companies can now monitor their packaging's environmental impact in real-time, enabling better inventory management, reducing overproduction and waste. QR codes and NFC tags allow consumers to access product information, such as origin, ingredients and recycling instructions. Problematic areas such as excessive packaging or overuse of materials can be identified and measures can be implemented to reduce them. As a result, smart packaging supports circular economy initiatives by integrating reusable or biodegradable materials.

b. The Role of IoT in Modern Waste Management

FIGURE 4: Smart waste management

IoT plays a significant role in modern waste management by enhancing efficiency, reducing cost and promoting sustainability. It helps to streamline the operations, from waste collection to material recycling. IoT enabled smart devices installed in bins, vehicles, and recycling facilities offer unprecedented insights, helping to address inefficiencies and environmental challenges.

One critical application is the use of IoT enabled smart waste bins. These bins are equipped with sensors that monitor their waste levels in real-time which automatically transmit this data to waste management teams when they are nearly full. By analyzing data from smart bins, waste collection routes can be optimized to eliminate unnecessary collection trips and minimize fuel usage, thereby reducing carbon emissions. Furthermore, sensors can identify the type of waste they contain which helps in segregation and recycling outcomes.

Optimized collection routes are another game-changer. IoT-enabled waste management systems gather data from various bins and generate dynamic schedules, thereby finding areas with the highest requirement. This helps to reduce operational costs and also lowers environmental impacts, by integrating technological innovation and sustainability.

c. Challenges to IoT-enabled smart packaging & IoT Adoption in Waste Management

1. Implementing IoT solutions requires significant upfront investment in technology

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIV, Issues– II (A) March – April, 2025

OPEN ACCESS Original Research Article

and infrastructure that can be prohibitive for smaller municipalities or businesses.

2. Data security is another pressing concern. IoT systems generate vast amounts of data, and protecting data collected by IoT devices from cyber threats is crucial. Implementing robust cybersecurity measures is essential to ensure the integrity and confidentiality of collected data.
3. Technical comlaxity also poses a challenge. The successful deployment of IoT requires expertise in installation and maintenance. Moreover
4. The environmental impact of IoT devices themselves cannot be ignored as their usage grows globally. Recycling e-waste from IoT devices must be prioritized to ensure that the solutions don't contribute to the problem.

Real-World Applications: Success Stories

Cities worldwide are availing the benefits of IoT in waste management. Copenhagen, Denmark, serves as a prime example. The city has deployed a smart waste management system where sensors monitor bin fill levels and optimize collection routes. This initiative has reduced operational costs by 20% while significantly lowering carbon emissions.

IoT plays a central role in smart city initiatives in Singapore and Dubai. Real-time data from waste bins informs authorities about waste generation patterns, enabling efficient allocation of resources. These cities set an example for how IoT can drive sustainable urban development.

Conclusion:

The integration of IoT into the gig economy holds immense potential for enhancing worker productivity, improving safety, and promoting sustainability. By leveraging IoT-enabled devices and systems, businesses can address the challenges of gig work while creating a more efficient, safe, and sustainable labor market. However, careful consideration of ethical, practical, and environmental issues is essential to ensure that IoT adoption benefits all stakeholders in the gig economy.

References:

1.*https://www.drishtiias.com/daily-updates/daily-news-analysis/rise-and-challenges-of-india-s-gig-economy*

2.https://forumias.com/blog/gig-workers-in-india-challenges-and-way-forward-explained-pointwise/

3. https://flex.amazon.com

4.https://www.smartsight.in/industry-insights/connected-vehicles-internet-of-things

5. https://www.iotforall.com/iot-future-of-delivery

6. https://www.netguru.com/blog/robots-and-drones-delivery

7. https://www.brainvire.com/blog/how-iot-is-fueling-the-on-demand-economy/

8. https://peoplesafe.co.uk/blogs/health-safety-risks-in-the-gig-economy/

9.https://www.linkedin.com/pulse/occupational-health-safety-gig-economy-db-hse-international-pdktc

10.https://www.rfwireless-world.com/ApplicationNotes/Applications-of-IoT.html

11..https://www.beyondidentity.com/resource/companies-cybersecurity-concerns-with-gig-economy

12. https://www.digiteum.com/iot-workplace-safety/

Cite This Article: ***Mrs. Gonsalves G.F., Mrs. Dsouza P.A. & Mrs. Mhatre S.S. (2025).*** *The Gig Economy and the Role of Internet of Things (IoT) in Enhancing Worker Productivity, Safety and Sustainability.* **In Aarhat Multidisciplinary International Education Research Journal**: Vol. XIV (Number II, pp. 190–196).