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An Advanced Framework to Design A Smart Store System using IoT, AI, and Data Analytics that Improves Business Processes for Micro and Small Businesses

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Abstract*: Small and Microbusinesses struggle for their survival as they are always short of resources, clients and data to make informed decisions. Only if they knew what to sell, when to sell and whom to sell, they would not only survive but also thrive. This is where they need some help of technology like IoT and AI to take their business to the next level. IoT and AI can be used as a combination to improve various business processes for small and micro businesses. This led to the invention of a new Framework which uses IoT, AI and Data Analytics to improve business processes for various types of businesses. Let us take a service example like selling personal use stuff such as clothes, jewelry, shoes, etc. These types of businesses could use printable near field RFID tags that can be bought for as low as $0.01 each (price may go down for bulk purchases) to put on the products. This tag will carry various information like purchase history, price history, discounts, availability, etc. With the use of these tags, businesses would be able to personalize the buying experience for the customers and learning their shopping habits. This could open up greater revenue opportunities by improving the existing customer base [1][4]. In this paper, we will discuss this framework and an implementation of it in a retail world.

***Keywords* : IoT, IoT AI in Business, Advanced Analytics, Sensors in Service, Open Framework.**

I. INTRODUCTION

Every time a customer visits a business or a retail store, he/she would search for a desired product in the store and without spending much time, he/she would walk away after purchasing it. He/she wouldn't spend much time browsing products which are out of his/her interest. Even if the store owners try to rearrange the placement of the products in the store to attract people, the customers would often walk away without noticing the irrelevant things in their way [7]. This could be a serious problem for micro and small enterprises with a small customer base as their primary aim is to grow their businesses for survival. What if we could give relevant suggestions to the customers while they are buying something from a store?

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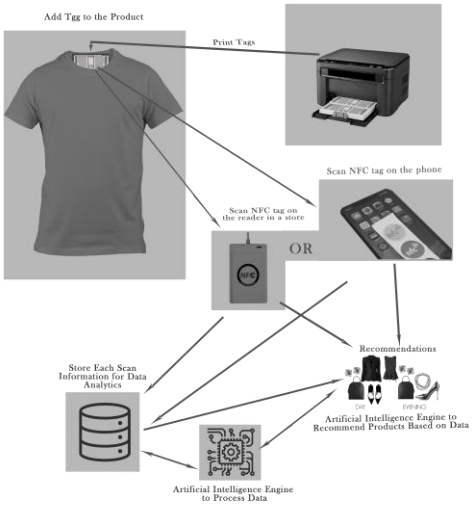
What if we could learn their shopping habits personalize the shopping experience even better by offering discounts and interesting offers [9][8]? This is the much-needed help for small and micro businesses where they can better manage their inventory and resources for maximum profitability.

II. FRAMEWORK

This is a framework of a Smart Store System which would greatly help the micro and small business owners to improve their business processes. This framework uses IoT, AI, and Data Analytics to change the shopping experience. The idea is to use RFID tags on each product, so whenever a customer buys a product, he/she will get an instant recommendation on his/her mobile or nearby screens while paying to the cashier. The smart AI and IoT-based RFID system will work together to personalize the shopping experience by suggesting the best recommendations to the customer [4][6].



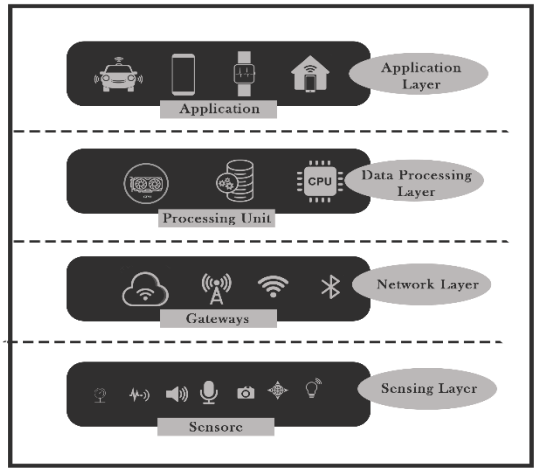
The businesses will be opening more revenue opportunities with personalized recommendations. They will also learn about the shopping habits of the customer. Thus, business owners can organize their store according to customer preference in the first place [8]. This framework can also be used for figuring out inventory, stocking, seasonality and manufacturing load.

The businesses can track seasonal changes and demands in order to stock products in their store. By this way, there won't be an 'out of stock' situation ever. The AI would be smart enough to analyze the demand and inform about the remaining stocks before they end up.

The store managers would be able to make informed decisions after learning about their remaining stocks. If we implement this framework in the restaurant businesses, we can expect some truly astonishing results. RFIDs could be attached to the food boxes/packaging/plates. These businesses will learn which items on their menu sell the best. Hence, they will be better prepared to serve those dishes once ordered. This will greatly reduce the waiting time at the restaurants. The AI will display the most preferred dishes on the nearby screens to attract more customers. In addition, better complimentary items like drinks, fries, etc. can be suggested. Altogether, this framework will bring better human resources management and financial management in businesses [5][8][10].

III. MATERIALS AND METHODS

A. Internet of Things



It means a world of interconnected objects that are uniquely addressable. Components like RFID tags, sensors, actuators, mobile devices, etc. are making it possible to have an interconnected world.

Today, data consumed and produced keeps growing at a rapid rate. There are different IoT-based applications being used in different domains and have succeeded in providing huge benefits. In this framework, data analytics is being used to analyze big and small data sets with different data properties to bring actionable insights and meaningful conclusions[4].

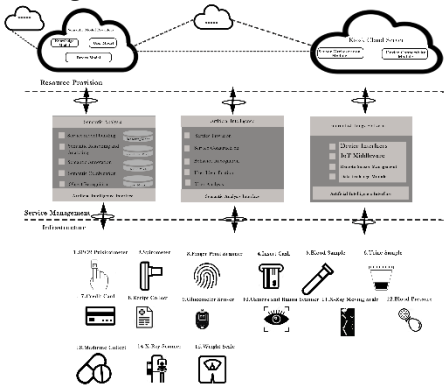
By implementing IoT-based solutions, businesses will be able to make smarter and informed decisions in order to improve revenue as a result. They can bring revolution to stores and businesses which are thriving to attract customers. Analytics by IoT devices can make better store design. By placing IoT devices at several places across the store, businesses can learn which area is the most visited area. By collecting and analyzing data from the store, a store can produce predictive analysis. This means that store managers are likely to learn where the customer is likely to go. Or what products they are likely to buy on a specific time of the day?

This prediction with the use of IoT devices can greatly increase the customer's perception of the store and products. By this way, the stores or businesses have more chances to have impulse buyers and repeat customers[8][10].

B. Artificial Intelligence

AI or Artificial intelligence devices are meant to simulate human thinking capabilities in order to fulfill repetitive or complex tasks. AI-based programs and systems have the ability to gather information, utilize logical policies to process data, recognize and correct mistakes. In the business world, rather than having a role as a replacement for human intelligence and ingenuity, AI is seen as a supporting hand. However, it can process and analyze the bulks of data more quickly and efficiently than a human mind. Today, in some industries AI is powerful enough to automate the business intelligence and analytics process by providing a holistic end-to-end solution. Many banks are using AI-enabled applications to detect any kind of fraudulent activities under their jurisdiction. Many online shopping websites are using AI-based chatbots which are providing customer support as they are able to understand human conversations. These bots can help the customers to find out what they want to know, extract information from the website, and direct them to a particular relevant page [1][2][3].

AI won't necessarily replace humans any time soon, however, it will certainly gear up organizations to do much more. The impact of AI will only be magnified in the coming decade, as most of the industries will transform their business model in order to take its full advantage. AI will create its greatest impact on three components of businesses; marketing, finance, and organization structure [3].



C.Sensors and Devices

Multiple RFID tags, NFC tags, readers and computers will be used to build the Smart Store System. These RFIDs are very cost-effective and time-saving solutions for micro and small businesses to grow customers. Each RFID costs around $0.01 (less if you buy in bulk) and the best thing about them is that they are recyclable. Thus, storekeepers need to make sure that the customer doesn't checkout with the tags while leaving the store. Gathering and organizing the correct information is important to ensure the overall success of a business. RFIDs do this by producing accurate data for their finances and sales projections. By using these tags, a store/business will learn what products their customers are buying, how much inventory is left, and recommend relevant products based on their customer's current purchase [10]. These types of sensors make it possible to collect high amounts of data remotely.

This means that a store/business owner can collect data on his/her daily operations without being dependent upon their employees or without manually entering the data.

The first thing a business should do to switch to RFID tags is to tagging the tags to its products. Then, they need to have strong software which could manage the RFIDs. Most Airlines have started to use RFIDs to track baggage as it moves from place to another and eliminate the problem of lost baggage [4].

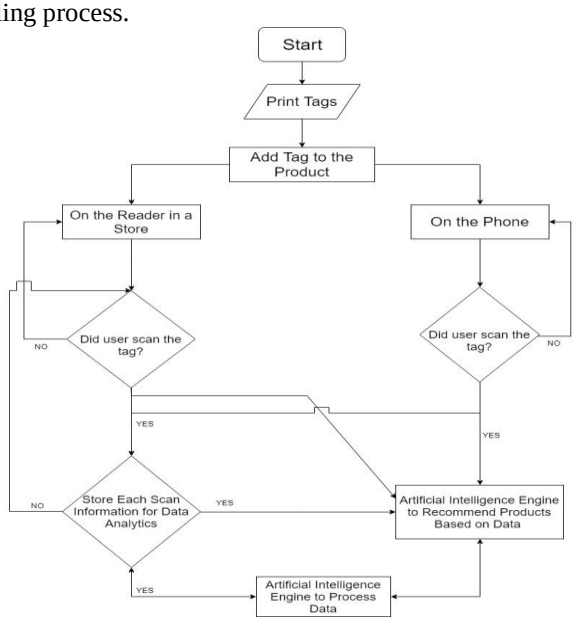
IV. RESEARCH AND DESIGN

The research behind this invention was quite intensive. This research was done with the main objective to improve the business process of Micro and Small businesses. Figuring out the right combination of IoT and AI was important to make the system work seamlessly. This needed tons of trial and error to take the best advantage of machine learning. Earlier, only IoT was considered in the development of the Smart Store System. However, it was not possible to process such a huge amount of data and recommendation for the customers by just using IoT-based technologies. For this reason, AI also came into the development of this system. The main work of collecting the data from the products is done by the IoT devices. However, smart AI is required to process and generate recommendations for customers. There's a smart algorithm that works efficiently to understand the buying habits of the customers. It instantly searches relevant products from the store and suggests them to according to the product purchased by the customer. This AI runs works with filters like size/color/weight/price/material/natural/manmade to improve the recommendations [4].

The framework is suitable for many verticals and applicable to improve various other business processes other than selling process.Next section describes the detailed flow chart to show the flow of the system.

V. FRAMEWORK FLOWCHART

Following flowchart shows the entire step by step process to make products visible to customers by using IoT, AI and Data Analytics. Small and Micro businesses could also use this framework to improve other business processes than selling process.



1. In the beginning, RFID tags get printed from the manufacturers. Then, the business owner purchases the tags.
2. Next step is to tag (stick) these RFID tags to the products in the inventory of the store.
3. The customer needs to scan the product either on his/her phone or reader present at the store.
4. The information gathered from the RFID of the product gets stored for Data analysis.
5. The Artificial intelligence engine will analyze the product info to recommend relevant products to the customer
6. The recommendations list either gets presented to a display present in the store or customer's phone (this depends whether the product was scanned by a phone or an RFID reader present in the phone). This increases the chances of getting more impulse buyers for the business.
7. The stored info is used for inventory management, store design, personalizing, prioritizing products, etc.

VI. ADVANCED USES

This smart store system can be adopted into multiple places to improve efficiency and productivity. If a fast-food business implements this in their operation, they could predict the orders of their customers can reduce their waiting time at the restaurant. This system can be implemented in schools to conduct automatic attendance (RFID tags can be attached to school bags). All the airports/shipment companies could use this system to have the pinpoint location of the package/baggage. GYMs can keep a track on their equipment and ensure maintenance on time. Theatres can also adopt the same system to give exciting offers and discounts to the moviegoers.

The possibilities are endless by using IoT and AI together. The algorithm-based recommendation system is the most notable feature of the entire system. It is very similar to the algorithms used by Youtube or Netflix in the digital world to recommend users most relevant videos and movies. However, this system works in the real physical world where products are recommended to the customers. By adopting IoT and AI-based technology, the business will have enhanced products and services with increased operational efficiency [9][6][8].

VII. CONCLUSION

This Smart Store System has the capacity to improve business processes by attracting more customers, improving human resource management, improving financial management, and enhanced inventory management. The businesses will not go out of stock without their knowledge as the system keeps them updated about the inventory. By learning the shopping habits, the stores can organize store design to create an impactful image in front of the customers. Microbusinesses and small businesses will be benefiting the most out of this inexpensive RFID based framework [4].

REFERENCES

1. Euchner, J. (2019). Little ai, Big AI—Good AI, Bad AI. Research-Technology Management,62(3), 10-12. doi:10.1080/08956308.2019.1587280
2. Hagendorff, T., & Wezel, K. (2019). 15 challenges for AI: Or what AI (currently) can't do. Ai & Society. doi:10.1007/s00146-019-00886
3. Spector, L. (2006). Evolution of artificial intelligence. Artificial Intelligence,170(18), 1251-1253. doi:10.1016/j.artint.2006.10.009
4. Chaudhuri, A. (2018). Internet of Things and Its Potential. Internet of Things, for Things, and by Things,3-16. doi:10.1201/9781315200644-1
5. Consumer Analytics and Big Data. (2015). Marketing Analytics,209-264. doi:10.1142/9789814641371_0008
6. Grady, N. W., Underwood, M., Roy, A., & Chang, W. L. (2014). Big Data: Challenges, practices and technologies: NIST Big Data Public Working Group workshop at IEEE Big Data 2014. 2014 IEEE International Conference on Big Data (Big Data). doi:10.1109/bigdata.2014.7004470
7. International Journal of Retail & Distribution Management. (1993). International Journal of Retail & Distribution Management,21(6), 3-31. doi:10.1108/eb018438
8. Introduction: What Are Predictive Analytics? (2013). Killer Analytics,1-20. doi:10.1002/9781118691731.ch0
9. Pinder, J. P. (2017). Business analytics is making decisions. Introduction to Business Analytics Using Simulation,1-21. doi:10.1016/b978-0-12-810484-2.00001-3
10. Soldatos, J. (2016). Building Blocks for IoT Analytics. Building Blocks for IoT Analytics,1-294. doi:10.13052/rp-9788793519046

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Mayur Ramgir with more than 18 years of experience is a technology practitioner on Java and philanthropist by heart. Author with reputed publishers like Wiley, Pearson, Packt, and BPB. Authored 4 books on Java, and International Award-winning books one on Leadership, and two on Innovation. He has completed MS in Computational Science and Engineering from Georgia Institute of Technology (USA), M.Sc. in Multimedia Application and Virtual Environment from University of Sussex (UK), and B.Sc. Computer Science from University of Mumbai (India). Mayur Ramgir has successfully delivered many large-scale projects and has extensive experience on scaling technology startups. He is a fellow of "The World Technology Network" and a finalist in the well reputed international award 'The World Technology Award 2017'.

He has been awarded "Pride of The Nation" award by Honorable Home Minister of India Mr. Rajnath Singh along with Veterans India including Maj. Gen. G D Bakshi at the Vijay Diwas Celebration 2018 in New Delhi for the contribution in the field of innovation and philanthropy.

He has been awarded "Champions of Change" award by Honourable Vice President of India, Mr. M. Venkaiah Naidu in the presence of former Chief justice of India K. G. Balakrishnan. He is one of the members of 35 high achievers' group in India consist of various Ministers, IAS officers, IPS officers, Social Workers, Educationist and Healthcare specialist.

He has been awarded "Man of Excellence" by Indian Achiever's Forum for his exceptional service for the betterment of society as Change-maker.

He is known for his world's first global virtual innovation lab which was featured in the UK's leading newspaper Daily Mirror.

Mayur Ramgir was featured on various TV and printed media including Fox News, NBC News, CBS News, Fox Business, Bloomberg International TV, Inc. magazine, Daily Mirror, The Huffington Post and several more. He is also a contributing author of New York Daily Newspaper, Software Development Times magazine, Newsmax Finance, Singapore's top entrepreneurship magazine "Young Upstarts", and several more.