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IoT – A Pathway to Smart India – Part 3 (Future Scope)

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Abstract : In 3rd Part of this exploratory paper, the Future Scope and Application of IoT in detail are explored. Here Industry Applications, Health Applications & Environment Applications are explored in brief. Some innovative IOT enabled devices also explored for novice readers.

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1. FUTURE SCOPE OF IoT

Using this system as framework, the system can be expanded to include various other options which could include home security feature like capturing the photo of a person moving around the house and storing it onto the cloud. This will reduce the data storage than using the CCTV camera which will record all the time and stores it. The system can be expanded for energy monitoring, or weather stations. This kind of a system with respective changes can be implemented in the hospitals for disable people or in industries where human invasion is impossible or dangerous, and it can also be implemented for environmental monitoring.

2. APPLICATIONS OF IoT

IoT has applications across all industries and markets. It spans user groups from those who want to reduce energy use in their home to large organizations who want to streamline theiroperations. It proves not just useful, but nearly critical in many industries as technologyadvances and we move towards the advanced automation imagined in the distant future.

ENGINEERING INDUSTRY AND INFRACTURE

Applications of IoT in these areas include improving production, marketing, service delivery, and safety. IoT provides a strong means of monitoring various processes; and real transparency creates greater visibility for improvement opportunities.

The deep level of control afforded by IoT allows rapid and more action on those opportunities, which include events like obvious customer needs, nonconforming product, malfunctions in equipment, problems in the distribution network, and more.

Example - Joan runs a manufacturing facility that makes shields for manufacturing equipment. When regulations change for the composition and function of the shields, the new appropriate requirements are automatically programmed in production robotics, and engineers are alertedabout their approval of the changes.

GOVERNMENT AND SAFETY

IoT applied to government and safety allows improved law enforcement, defense, city planning, and economic management. The technology fills in the current gaps, corrects many current flaws, and expands the reach of these efforts. For example, IoT can help city planners have a clearer view of the impact of their design, and governments have a better idea of the local economy.

Example - Joan lives in a small city. She's heard about a recent spike in crime in her area, and worries about coming home late at night. Local law enforcement has been alerted about the new "hot" zone through system flags, and they've increases their presence. Area monitoring devices have detected suspicious behavior, and law enforcement has investigated these leads to prevent crimes.

HOME AND OFFICE

In ourdaily lives, IoT provides a personalized experience from the home to the office to theorganizations we frequently do business with. This improves our overall satisfaction, enhances productivity, and improves our health and safety. For example, IoT can help us customize our office space to optimize our work.

Example - Joan works in advertising. She enters her office, and it recognizes her face. It adjusts the lightingand temperature to her preference. It turns on her devices and opens applications to her lastworkingpoints.Her office door detected and recognized a colleague visiting her office multiple times before she arrived. Joan's system opens this visitor's messages automatically.

HEALTH AND MEDICINE

IoT pushes us towards our imagined future of medicine which exploits a highly integrated

network of sophisticated medical devices. Today, IoT can dramatically enhance medical research, devices, care, and emergency care. The integration of all elements provides more accuracy, more attention to detail, faster reactions to events, and constant improvement while reducingthe typical overhead of medical research and organizations.

Example - Joan is a nurse in an emergency room. A call has come in for a man wounded in an altercation.The system recognized the patient and pulls his records. On the scene, paramedic equipment captures critical information automatically sent to the receiving parties at the hospital. The system analyzes the new data and current records to deliver a guiding solution. The status ofthe patient is updated every second in the system during his transport. The system promptsJoan to approve system actions for medicine distribution and medical equipment preparation.

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IoT MEDIA MARKETING AND ADVERTISING

The applications of IoT in media and advertising involve a customized experience in which the system analyzes and responds to the needs and interests of each customer. This includes their general behavior patterns, buying habits, preferences, culture, and other characteristics.

Marketing and Content Delivery

IoT functions in a similar and deeper way to current technology, analytics, and big data. Existing technology collects specific data to produce related metrics and patterns over time, however, that data often lacks depth and accuracy. IoT improves this by observing more behaviors and analyzing them differently.

- This leads to more information and detail, which delivers more reliable metrics and
- patterns.
- It allows organizations to better analyze and respond to customer needs or preferences.
- It improves business productivity and strategy, and improves the consumer experience
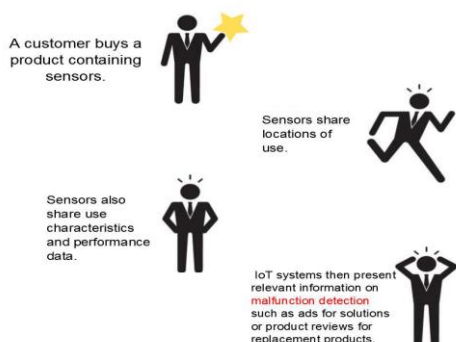- by only delivering relevant content and solutions.

Figure   Marketing and Content Delievery Example

Improved Advertising - Current advertising suffers from excess and poor targeting. Even with today's analytics, modern advertising fails. IoT promises different and personalized advertising rather than one-size-fitsall strategies. It transforms advertising from noise to a practical part of life because consumers interact with advertising through IoT rather than simply receiving it. This makes advertising more functional and useful to people searching the marketplace for solutions or wondering if those solutions exist.

IoT ENVIRONMENTAL MONITERING

The applications of IoT in environmental monitoring are broad: environmental protection,

extreme weather monitoring, water safety, endangered species protection, commercial farming,and more. In these applications, sensors detect and measure every type of environmental change.

Air and Water Pollution

Current monitoring technology for air and water safety primarily uses manual labor along with advanced instruments, and lab processing. IoT improves on this technology by reducing the need for human labor, allowing frequent sampling, increasing the range of sampling and monitoring, allowing sophisticated testing on-site, and binding response efforts to detection systems. This allows us to prevent substantial contamination and related disasters.

Extreme Weather

Though powerful, advanced systems currently in use allow deep monitoring, they suffer from using broad instruments, such as radar and satellites, rather than more granular solutions. Their instruments for smaller details lack the same accurate targeting of stronger technology. New IoT advances promise more fine-grained data, better accuracy, and flexibility. Effective forecasting requires high detail and flexibility in range, instrument type, and deployment. This allows early detection and early responses to prevent loss of life and property.

Commercial Farming

Today's sophisticated commercial farms have exploited advanced technology and biotechnology for quite some time, however, IoT introduces more access to deeper automation and analysis.
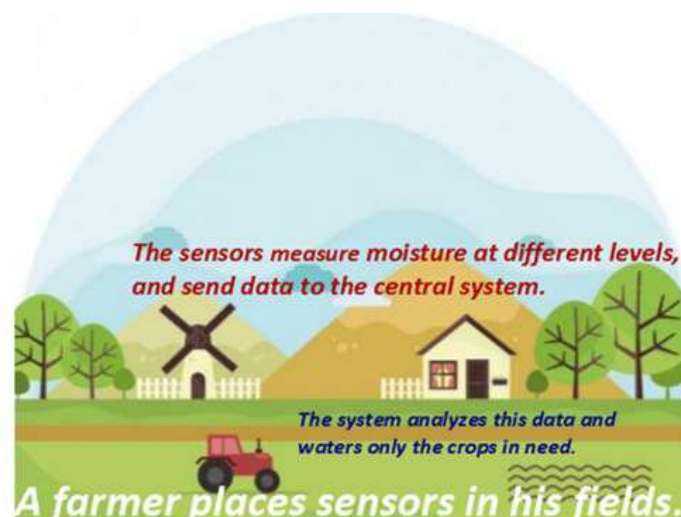

Figure Commercial Farming

Much of commercial farming, like weather monitoring, suffers from a lack of precision and requires human labor in the area of monitoring. Its automation also remains limited.

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IoT allows operations to remove much of the human intervention in system function, farming analysis, and monitoring. Systems detect changes to crops, soil, environment, and more. They optimize standard processes through analysis of large, rich data collections. They also prevent health hazards (e.g., *e. coli*) from happening and allow better control.

IoT MANUFACTURING APPLICATIONS

Manufacturing technology currently in use exploits standard technology along with modern

distribution and analytics. IoT introduces deeper integration and more powerful analytics. This opens the world of manufacturing in a way never seen before, as organizations become fullydeveloped for product delivery rather than a global network of suppliers, makers, and

distributors loosely tied together.

Intelligent Product Enhancements

Much like IoT in content delivery, IoT in manufacturing allows richer insight in real-time. This dramatically reduces the time and resources devoted to this one area, which traditionally requires heavy market research before, during, and well after the products hit the market.

IoT also reduces the risks associated with launching new or modified products because it provides more reliable and detailed information. The information comes directly from market use and buyers rather than assorted sources of varied credibility.

Dynamic Response to Market Demands

Supplying the market requires maintaining a certain balance impacted by a number offactors such as economy state, sales performance, season, supplier status, manufacturing facility status, distribution status, and more. The expenses associated with supply present unique challenges given today's global partners. The associated potential or real losses can dramatically impact business and future decisions.

IoT manages these areas through ensuring fine details are managed more at the system level

rather than through human evaluations and decisions. An IoT system can better assess and

control the supply chain (with most products), whether demands are high or low.

Lower Costs, Optimized Resource Use, and Waste Reduction

IoT offers a replacement for traditional labor and tools in a production facility and in the overallchain which cuts many previously unavoidable costs; for example, maintenance checks or teststraditionally requiring human labor can be performed remotely with instruments and sensors ofan IoT system.

IoT also enhances operation analytics to optimize resource use and labor, and eliminate varioustypes of waste, e.g., energy and materials. It analyzes the entire process from the source pointto its end, not just the process at one point in a particular facility, which allows improvement tohave a more substantial impact. It essentially reduces waste throughout the network, and returns those savings throughout.

Figure XRS Relay Box : This XRS relay box connects all truck devices (e.g., diagnostics anddriver cell) to the XRS fleet management supporting software, whichallows data collection.

Improved Facility Safety

A typical facility suffers from a number of health and safety hazards due to risks posed by

processes, equipment, and product handling. IoT aids in better control and visibility. Its monitoring extends throughout the network of devices for not only performance, but for dangerous malfunctions and usage. It aids (or performs) analysis and repair, or correction, of critical flaws.

Product Safety

Even the most sophisticated system cannot avoid malfunctions, nonconforming product, and

other hazards finding their way to market. Sometimes these incidents have nothing to do with the manufacturing process, and result from unknown conflicts.

In manufacturing, IoT helps in avoiding recalls and controlling nonconforming or dangerous product distribution. Its high level of visibility, control, and integration can better contain any issues that appear.

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III. IoT ENERGY APPLICATIONS

The optimization qualities of IoT in manufacturing also apply to energy consumption. IoT allowsa wide variety of energy control and monitoring functions, with applications in devices,commercial and residential energy use, and the energy source. Optimization results from thedetailed analysis previously unavailable to most organizations and individuals.

Residential Energy

The rise of technology has driven energy costs up. Consumers search for ways to reduce or

control consumption. IoT offers a sophisticated way to analyze and optimize use not only at

device level, but throughout the entire system of the home. This can mean simple switching off or dimming of lights, or changing device settings and modifying multiple home settings to optimize energy use.

IoT can also discover problematic consumption from issues like older appliances, damaged

appliances, or faulty system components. Traditionally, finding such problems required the useof often multiple professionals.

Commercial Energy

Energy waste can easily and quietly impact business in a major way, given the tremendous

energy needs of even small organizations. Smaller organizations wrestle with balancing costs ofbusiness while delivering a product with typically smaller margins, and working with limitedfunding and technology. Larger organizations must monitor a massive, complex ecosystem ofenergy use that offers few simple, effective solutions for energy use management.

Figure Smart Meter: This automated meter reader makes visits unnecessary, and also allows energy

companies to bill based on real-time data instead of estimates over time.

IoT simplifies the process of energy monitoring and management while maintaining a low cost and high level of precision. It addresses all points of an organization's consumption across devices. Its depth of analysis and control provides organizations with a strong means of managing their consumption for cost shaving and output optimization. IoT systems discover energy issues in the same way as functional issues in a complex business network, and provide solutions.

Reliability

The analytics and action delivered by IoT also help to ensure system reliability. Beyond

consumption, IoT prevents system overloads or throttling. It also detects threats to system performance and stability, which protects against losses such as downtime, damaged equipment, and injuries.

IV. IoT HEALTHCARE APPLICATIONS

IoT systems applied to healthcare enhance existing technology, and the general practice ofmedicine. They expand the reach of professionals within a facility and far beyond it. They increase both the accuracy and size of medical data through diverse data collection from large sets of real-world cases. They also improve the precision of medical care delivery through more sophisticated integration of the healthcare system.

Research

Much of current medical research relies on resources lacking critical real-world information. Ituses controlled environments, volunteers, and essentially leftovers for medical examination. IoTopens the door to a wealth of valuable information through real-time field data, analysis, and testing.

IoT can deliver relevant data superior to standard analytics through integrated instrumentscapable of performing viable research. It also integrates into actual practice to provide more key information. This aids in healthcare by providing more reliable and practical data, and betterleads; which yields better solutions and discovery of previously unknown issues.

It also allows researchers to avoid risks by gathering data without manufactured scenarios andhuman testing.

Devices

Current devices are rapidly improving in precision, power, and availability; however, they stilloffer less of these qualities than an IoT system integrating the right system effectively. IoTunlocks the potential of existing technology,

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and leads us toward new and better medical device solutions.

IoT closes gaps between equipment and the way we deliver healthcare by creating a logical

system rather than a collection of tools. It then reveals patterns and missing elements inhealthcare such as obvious necessary improvements or huge flaws.

Figure Smart Probe : The ClearProbe portable connected ultrasound device can use any computer anywhere as a supporting machine. The device sends all imaging records to the master system.

Care

Perhaps the greatest improvement IoT brings to healthcare is in the actual practice of medicine because it empowers healthcare professionals to better use their training and knowledge to solve problems. They utilize far better data and equipment, which gives them a window into blindspots and supports more swift, precise actions. Their decision-making is no longer limited by thedisconnects of current systems, and bad data.

IoT also improves their professional development because they actually exercise their talent

rather than spending too much time on administrative or manual tasks. Their organizational

decisions also improve because technology provides a better vantage point.

Medical Information Distribution

One of the challenges of medical care is the distribution of accurate and current information to patients. Healthcare also struggles with guidance given the complexity of following guidance devices not only improve facilities and professional practice, but also health in the daily livesof individuals.

IoT devices give direct, 24/7 access to the patient in a less intrusive way than other options.

They take healthcare out of facilities and into the home, office, or social space. They empower individuals in attending to their own health, and allow providers to deliver better and more granular care to patients. This results in fewer accidents from miscommunication, improved patient satisfaction, and better preventive care.

Emergency Care

The advanced automation and analytics of IoT allows more powerful emergency support services, which typically suffer from their limited resources and disconnect with the base facility. It provides a way to analyze an emergency in a more complete way from miles away. It alsogives more providers access to the patient prior to their arrival. IoT gives providers critical information for delivering essential care on arrival. It also raises the level of care available to apatient received by emergency professionals. This reduces the associated losses, and improves emergency healthcare.

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