

IoT – A Pathway to Smart India – Part 4 (Housing & Transport)

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Abstract : In 4th Part of this exploratory paper, in continuation of Future Scope and Application of IoT Building Housing Applications, Transport Applications, Educational Applications & Law Enforcement Applications are explored in brief. Like previous part 3, some innovative IOT enabled devices also explored for reader's info.

I. IoT BUILDING HOUSING APPLICATIONS

IoT applied to buildings and various structures allows us to automate routine residential and commercial tasks and needs in a way that dramatically improves living and working environments. This, as seen with manufacturing and energy applications, reduces costs, enhances safety, improves individual productivity, and enhances quality of life.

Environment and Conditioning

One of the greatest challenges in the engineering of buildings remains management of environment and conditions due to many factors at work. These factors include building materials, climate, building use, and more. Managing energy costs receives the most attention, but conditioning also impacts the durability and state of the structure.

IoT aids in improving structure design and managing existing structures through more accurate and complete data on buildings. It provides important engineering information such as how well a material performs as insulation in a particular design and environment.

Health and Safety

Buildings, even when constructed with care, can suffer from certain health and safety issues. These issues include poor performing materials, flaws that leave the building vulnerable to extreme weather, poor foundations, and more.



Figure Smart Plug : The Boss 220 smart plug allows the user to monitor, control, optimize, and automate all plug-in devices. Users employ their mobile device or desktop to view performance information and control devices from anywhere.

Current solutions lack the sophistication needed to detect minor issues before they become major issues, or emergencies. IoT offers a more reliable and complete solution by observing issues in a fine-grained way to control dangers and aid in preventing them; for example, it can measure changes in a system's state impacting fire safety rather than simply detecting smoke.

Productivity and Quality of Life

Beyond safety or energy concerns, most people desire certain comforts from housing or commercial spaces like specific lighting and temperature. IoT enhances these comforts by allowing faster and easier customizing. Adjustments also apply to the area of productivity. They personalize spaces to create an optimized environment such as a smart office or kitchen prepared for a specific individual.

II. IoT TRANSPORTATION APPLICATIONS

At every layer of transportation, IoT provides improved communication, control, and data distribution. These applications include personal vehicles, commercial vehicles,

trains, UAVs, and other equipment. It extends throughout the entire system of all transportation elements such as traffic control, parking, fuel consumption, and more.

Rails and Mass Transit

Current systems deliver sophisticated integration and performance, however, they employ older technology and approaches to MRT. The improvements brought by IoT deliver more complete control and monitoring. This results in better management of overall performance, maintenance issues, maintenance, and improvements. Mass transit options beyond standard MRT suffer from a lack of the integration necessary to transform them from an option to a dedicated service. IoT provides an inexpensive and advanced way to optimize performance and bring qualities of MRT to other transportation options like buses. This improves services and service delivery in the areas of scheduling, optimizing transport times, reliability, managing equipment issues, and responding to customer needs.

Road

The primary concerns of traffic are managing congestion, reducing accidents, and parking. IoT allows us to better observe and analyze the flow of traffic through devices at all traffic observation points. It aids in parking by making storage flow transparent when current methods offer little if any data.



Figure Smart Road Sign : This smart road sign receives data and modifications to better inform drivers and prevent congestion or accidents.

Accidents typically result from a number of factors, however, traffic management impacts their frequency. Construction sites, poor rerouting, and a lack of information about traffic status are all issues that lead to incidents. IoT provides solutions in the form of better information sharing with the public, and between various parties directly affecting road traffic.

Automobile

Many in the automotive industry envision a future for cars in which IoT technology makes cars "smart," attractive options equal to MRT. IoT offers few significant improvements to personal vehicles. Most benefits come from better control over related infrastructure and the inherent flaws in automobile transport; however, IoT does improve personal vehicles as personal spaces. IoT brings the same improvements and customization to a vehicle as those in the home.

Commercial Transportation

Transportation benefits extend to business and manufacturing by optimizing the transport arm of organizations. It reduces and eliminates problems related

to poor fleet management through better analytics and control such as monitoring idling, fuel consumption, travel conditions, and travel time between points. This results in product transportation operating more like an aligned service and less like a collection of contracted services.

III. 6.12 IoT EDUCATION APPLICATIONS

IoT in the classroom combines the benefits of IoT in content delivery, business, and healthcare. It customizes and enhances education by allowing optimization of all content and forms of delivery. It enables educators to give focus to individuals and their method. It also reduces costs and labor of education through automation of common tasks outside of the actual education process.

Education Organizations

Education organizations typically suffer from limited funding, labor issues, and poor attention to actual education. They, unlike other organizations, commonly lack or avoid analytics due to their funding issues and the belief that analytics do not apply to their industry.

IoT not only provides valuable insight, but it also democratizes that information through low cost, low-power small devices, which still offer high performance. This technology aids in managing costs, improving the quality of education, professional development, and facility management improvement through rich examinations of key areas:

- Student response, performance, and behavior
- Instructor response, performance, and behavior
- Facility monitoring and maintenance Data from other facilities
- Data informs them about ineffective strategies and actions, whether educational efforts or facility qualities. Removing these roadblocks makes them more effective.

Educators

Information provided by IoT empowers educators to deliver improved education. They have a window into the success of their strategies, their students' perspective, and other aspects of their performance. IoT relieves them of administrative and management duties, so they can focus on their mission. It automates manual and clerical labor, and facilitates supervising through features like system flags or controls to ensure students remain engaged.



Figure Smart ID Card : A school in Richmond, California, embeds RFID chips in ID cards to track the presence of students. Even if students are not present for check-in, the system will track and log their presence on campus.

IoT provides instructors with easy access to powerful educational tools. Educators can use IoT to perform as a one-on-one instructor providing specific instructional designs for each pupil; for example, using data to determine the most effective supplements for each student, and autogenerating content from lesson materials on-demand for any student.

The application of technology improves the professional development of educators because they truly see what works, and learn to devise better strategies, rather than simply repeating old or ineffective methods.

IoT also enhances the knowledge base used to devise education standards and practices. Education research suffers from accuracy issues and a general lack of data. IoT introduces large high quality, real-world datasets into the foundation of educational design. This comes from IoT's unique ability to collect enormous amounts of varied data anywhere.

Personalized Education

IoT facilitates the customization of education to give every student access to what they need. Each student can control their experience and participate in instructional design, and much of this happens passively. The student simply utilizes the system, and performance data primarily shapes their design. This combined with organizational and educator optimization delivers highly effective education while reducing costs.

IV. 6.13 IoT GOVERNMENT APPLICATIONS

IoT supports the development of *smart* nations and *smart* cities. This includes enhancement of infrastructure previously discussed (e.g., healthcare, energy, transportation, etc.), defense, and also the engineering and maintenance of communities.

City Planning and Management

Governing bodies and engineers can use IoT to analyze the often complex aspects of city planning and management. IoT simplifies examining various factors such as population growth, zoning, mapping, water supply, transportation patterns, food supply, social services, and land use. It gathers detailed data in these areas and produces more valuable and accurate information than current analytics given its ability to actually "live" with people in a city.



Figure Smart Transcans : Smart trash cans in New York tell garbage collectors when they need to be emptied. They optimize trash service by ensuring drivers only make necessary stops, and drivers modify their route to reduce fuel consumption.

In the area of management, IoT supports cities through its implementation in major services and infrastructure such as transportation and healthcare. It also aids in other key areas like water control, waste management, and emergency management. Its real-time and detailed information facilitate more prompt decisions in contrast to the traditional process plagued by information lag, which can be critical in emergency management.

Standard state services are also improved by IoT, which can automate otherwise slow processes and trim unnecessary state expenses; for example, it can automate motor vehicle services for testing, permits, and licensing.

IoT also aids in urban improvement by skipping tests or poor research, and providing functional data for how the city can be optimized. This leads to faster and more meaningful changes.

Creating Jobs

IoT offers thorough economic analysis. It makes previous blind spots visible and supports better economic monitoring and modeling. It analyzes industry and the marketplace to spot opportunities for growth and barriers.

National Defense

National threats prove diverse and complicated. IoT augments armed forces systems and services, and offers the sophistication necessary to manage the landscape of national defense. It supports better protection of borders through inexpensive, high performance devices for rich control and observation.

IoT automates the protection tasks typically spread across several departments and countless individuals. It achieves this while improving accuracy and speed.

V. 6.14 IoT LAW ENFORCEMENT APPLICATIONS

IoT enhances law enforcement organizations and practice, and improves the justice system. The technology boosts transparency, distributes critical data, and removes human intervention where it proves unnecessary.

Policing

Law enforcement can be challenging. IoT acts as an instrument of law enforcement which reduces manual labor and subjective decisions through better data, information sharing, and advanced automation. IoT systems shave costs by reducing human labor in certain areas such as certain traffic violations.

IoT aids in creating better solutions to problems by using technology in the place of force; for example, light in-person investigations of suspicious activities can be replaced with remote observation, logged footage of violations, and electronic ticketing. It also reduces corruption by removing human control and opinion for some violations.



Figure Smart Dart :This dart planted in a truck gate prevents dangerous car chases. A patrol car launches the tracking dart which pierces the vehicle. Then the main system receives all data needed to locate the vehicle.

Court System

Current court systems utilize traditional technology and resources. They generally do not exploit modern analytics or automation outside of minor legal tasks. IoT brings superior analytics, better evidence, and optimized processes to court systems which accelerate processes, eliminate excessive procedures, manage corruption, reduce costs, and improve satisfaction.

In the criminal court system, this can result in a more effective and fair system. In routine courtservices, it introduces automation similar to that of common government office services; foreexample, IoT can automate forming an LLC.

IoT combined with new regulations can remove lawyers from many common legal tasks or reduce the need for their involvement. This reduces costs and accelerates many processes which often require months of traversing legal procedures and bureaucracy.

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