

Smart Grids for Smart Cities:

Feasibility Study for Implementing Smart Street Lightning System under Smart City

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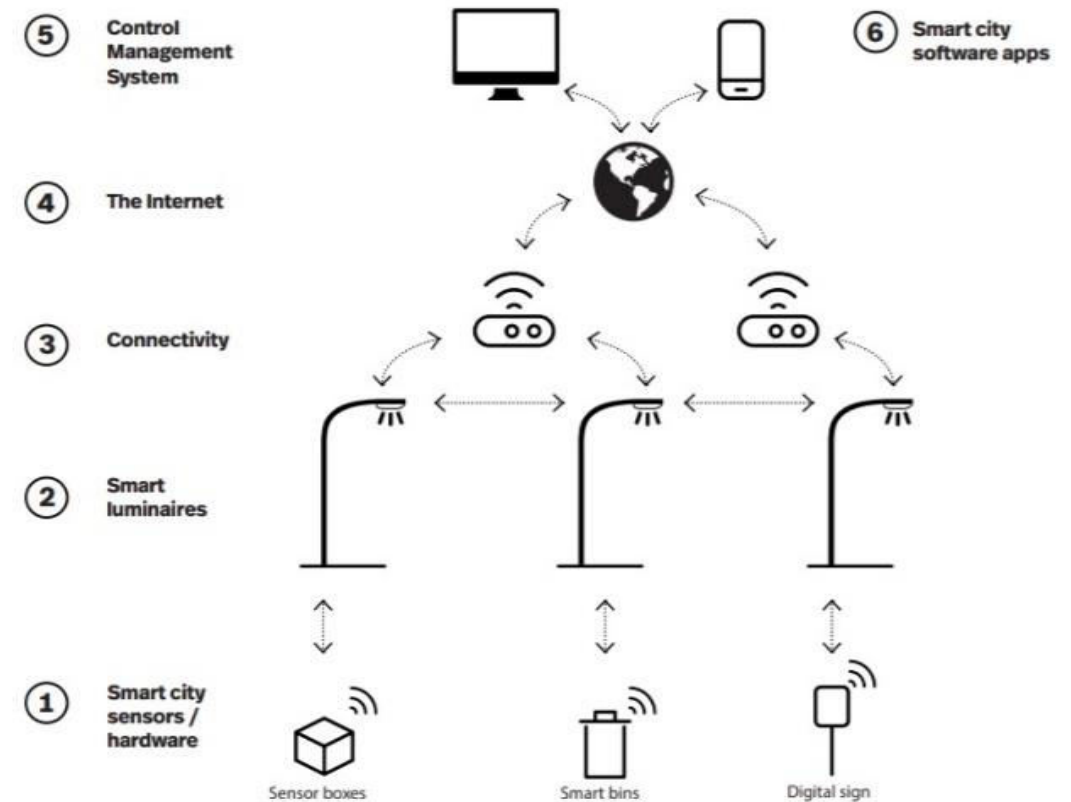
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- ✓ The world's cities are growing. Over half of the global population live in urban centres, with **over 23% of people living in cities** with over one million residents.
- ✓ This increase in urbanisation poses problems for the future. Local resources such as water and electrical supply are put under an increased amount of strain.
- ✓ In response to these difficulties, the current paradigm is a push for cities to adopt more sustainable urban practices and initiatives to maintain and improve the quality of living for its citizens.
- ✓ The primary aim of this research was to investigate whether a street light mounted sensor system for smart city applications is feasible with current technologies.
- ✓ **'Smart Lighting'** is a term used by lighting and networking companies to describe LED lighting which has the ability to be controlled by a Central Management System (CMS) in order to provide functional and flexible lighting.

To conduct the investigation for implementing Smart Street Light System, the following objectives were created to guide the study:

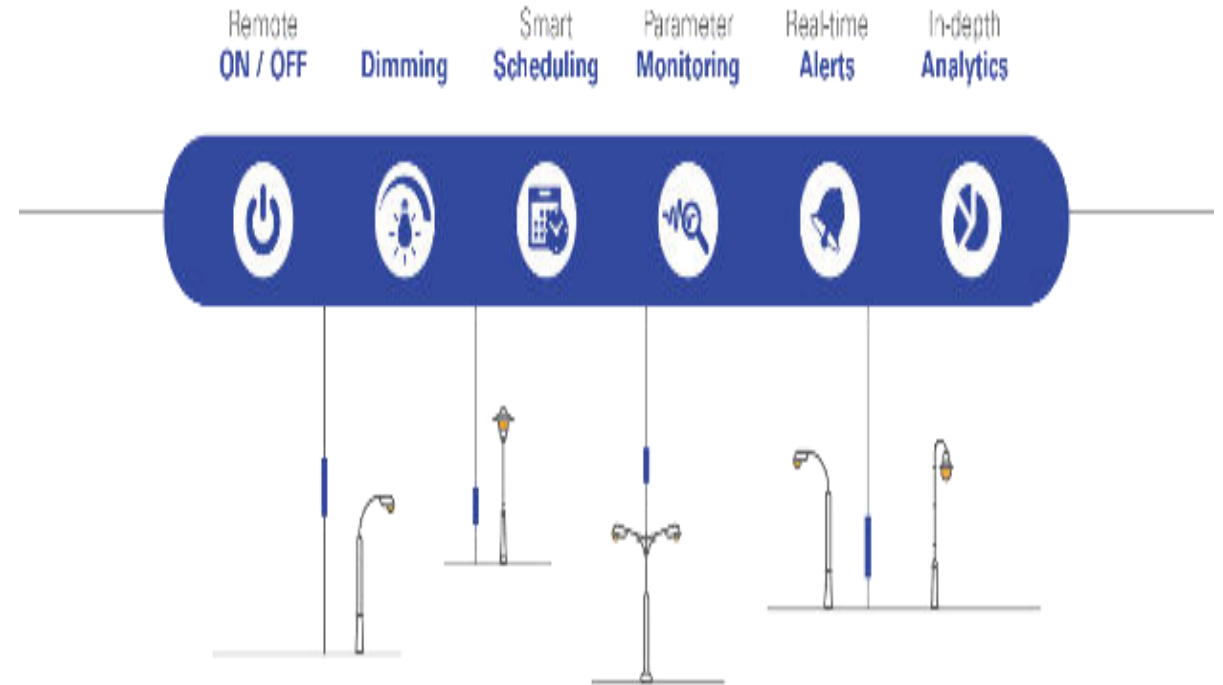
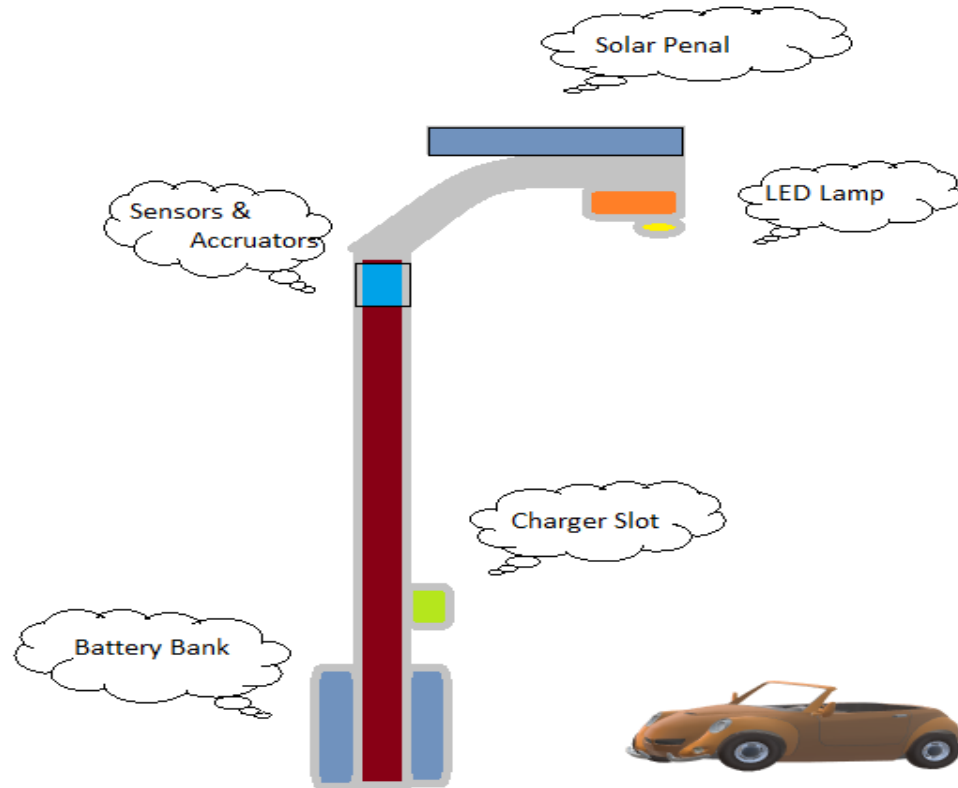
- ✓ The hardware solution must fit within the confines of a streetlight housing, roughly 200 x 100 x 60 millimetres, and weigh no more than 500 grams.
- ✓ Traffic detection had to be reliable from an overhead configuration at least 5.5 metres above the road level to coincide with preferred mounting heights in residential areas [11], and detect all traffic types (vehicle, cyclist, and pedestrian).
- ✓ The combined hardware costs should be less than Rs. 10,000/- or at least break even with the expected savings of its functions (i.e.: dimming, etc.) in its given deployment conditions within a 10-year period.
- ✓ The detection system had to be made of already existing and commercially available components and sensor technologies to determine if the current state-of-the-art systems would function in the given circumstances.

- ✓ How can Smart Lighting be leveraged to deliver a Smart City?
- ✓ What are the technology options to enable Smart Lighting?
- ✓ What are some of the considerations that could impact the use of Smart Lighting?
- ✓ What are potential pathways for implementing Smart Lighting?
- ✓ What other options are available for delivering a Smart City?



General configuration and components of a smart lighting system

Proposed Smart Street Light Systems



Proposed Smart Street Light Systems

- ✓ **Solar Penal:** The solar panel is one of the most important parts of a solar street light, as the solar panel can convert solar energy into electricity that the lamps can use. There are two types of solar panels commonly used in solar street lights: monocrystalline and polycrystalline.
- ✓ **Sensors and Actuators:** A smart street light controller consists of: Light source, Lamp socket, Ballast or driver, Smart streetlight controller.
- ✓ **Fast Charging Slot:** Street lighting standardised plug-and-play connectors. As smart control is an important issue for all stakeholders in the outdoor lighting industry, there have been significant investments and initiatives in standardizing lamp connectors.
- ✓ **Energy Efficient LED Lamp with embedded controllers:** A NEMA or Zhaga controller mounted on the lamp is simply not an option, but you still need the benefits of a smart, fully integrated lighting system. Embedded controllers are built to be particularly small, in order to fit inside the luminaire itself.

Application of Proposed Street Light Model

✓ **Vehicle Movement based Innovative Smart Highway Lighting System:**

Using a regression model with an adjusted R² of 0.90, it is estimated that by 2050, an extra 3.0 - 4.7 million km of road will be paved. The goal of this application is to design and implement advanced development in embedded systems for energy conservation in street lights.

✓ **Auto-Intensity Regulation of Streetlights using Arduino:**

Untimely switching on and off, and incessant glowing throughout the day without intensity regulation contribute to tremendous energy wastage. Also, manual control is tiring and outdated in this day and age of automation. The ultimate goal is to save energy, long term costs, and manpower along with attaining management of time and a systematic cycle of operation.

✓ **Smart LED Streetlight System with Web-Based Management System:**

Integration of sensors and ZigBee-based wireless sensor modules can furnish an optimal platform for an innovative LED streetlight application. In this application, consider the importance of CCT-based illumination and propose a novel integration of public weather data awareness, ZigBee-based wireless communication, and dynamic web-based management system for the state-of-art of smart LED streetlight system applicable to smart city

Application of Proposed Street Light Model

✓ **Energy Efficient Smart Street Lighting:**

A Smart Street Lighting System uses IoT sensors and can interact with software to improve its effectiveness and utility. Since streetlights must be turned on for the entire duration of the night, it is essential to find ways of reducing energy consumption to actualize a greener society. It can be done by integrating sensors that can detect movements and control the way streetlights behave through the gathered data.

✓ **Smart Street Light for Energy Saving Based on Vehicular Traffic Volume:**

Streetlights are one of the significant sources of electricity consumption, and an enormous amount of energy could be saved by converting conventional streetlights into smart streetlights. This application has discussed a novel idea of developing smart streetlights by utilizing the preinstalled surveillance cameras.

Key Takeaways

- ✓ This finding indicates that rural areas, which tend to have fewer public transport options and are less likely to have implemented traffic optimisation solutions of their own, are prime candidates for trialling the smart streetlight network.
- ✓ The literature suggests that there is a possible link between support and feelings of vulnerability within the home, and level of physical activity, which both warrant further investigation in future studies.
- ✓ The proposed model of Smart Street Lightening represents the feasibility to implement cost effective Smart Electric Street Light that is the future for the developing country like India under the smart city project.
- ✓ By adopting such concepts all proposed applications including development of small capacity Electric Vehicle Charging infrastructure, Traffic Management, dimming projects, use of Renewable Energy sources etc. can be fulfilled and manage the effective representation of Smart City concept.

Thank You

For discussions/suggestions/queries email: mananypathak@gmail.com

