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A REVIEW ON SMART STREET LIGHT FOR ENERGY CONSERVATION

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ABSTRACT-
Due to their traditional control systems, which automatically turn on and off using timers or light dependant resi stors, street lights consume a significant amount of electric energy (LDR). Furthermore, such saving alternative, resulting in a massive To address such difficulties, a green and smart street lighting system is required, especial ly with the rise of smart cities.Therefore, this project aims to design a smart and green street lighting system (SG Street-LS) for saving energy and utilizing renewable energy sources efficiently. The proposed system composes powerful ideas and concept to smoothly and efficiently control the operation of street lightings based on the sunlight availability and the motion detection by exploiting Arduinobased controllers. It also utilizes low power LEDs that supplied from solar panels to replace the conventional high-power lights. there are two conditions to be satisfied: LDR sensor detects lower level of lights intensity (darkness situations), and PIR motion sensor detects the presence of an object in the street (vehicle/human). Otherwise, the street's lights will be switched OFF. As a result, by implementing SG Street-LS, the electricity consumption for the street's lights can be reduced in addition to lowering CO2 level by using renewable energy sou

Index Terms- Street Light; Arduino, Green Technology; PIR; LDR

I. INTRODUCTION

Street lighting is vital either in urban or rural areas, where people used to have such lighting systems since 18th century [1]. It is the alternative light during night- time and also during bad weather conditions, in order to keep safety of the road users. In the past, streetlights were manually controlled, but the modern era is moving forward to implementing traditional systems in Eco-friendly ways [2-4]. The management control of the currently existing streetlights is quite simple, yet the number of streets has increased rapidly with the increasing urbanization rate [5]. Its aim is to yield a convenient street conditions during night-time, and also help drivers, pedestrians, cyclists and etc. to have a better sight [6]. For a low frequency of passer-by, the conventional street lighting systems seems to be ON overnight without its actual purpose. However, with the emergence of smart city and Internet of Things (IoT) evolution, more flexible- lighting technologies can contribute to more highly cost saving to nowadays street lighting system [7-10]. The use of light-emitting diode lamps (LED) and also wireless control of the lighting process from the control room, fast responds based on application of sensors – conserving street lighting system become reality [11-13]. Energy efficiency is the use of less energy and at the same time providing the same service with the aid of technology. However, energy conservation refers to the reduction for energy consumed in a process or system. Energy conservation is becoming a topic of great

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concern all over the world, especially in developing countries [4, 6, 11]. As cities expand, people are searching for a new solution to become more energy efficient and environmentally friendly. The green technology is rapidly growing up and becoming the alternative action and frequent being used especially in urban areas in order to get the benefit to the environment as well as energy saving by conserving the energy. One of the solutions that can be implemented to reduce energy consumption is by renovating their streetlight [10]. Another reason why developing cities change to green technology is to reduce the energy waste such as light pollution since most of the cities did not take into account about directing the light properly which can create over lit areas as well as emitted light pollution to the atmosphere. Previously, individual switches at every streetlight control the streetlight. This type of streetlights is inefficient as well as waste the cost that needs to hire the work force to operate the street light every day. The other technology is by using the light sensor in order to command the light to ON or OFF based on light intensity, and other streetlights use the timer combines with optical control. All these street light technologies have some lack in terms of energy efficiency and at the same time will affect the energy saving. Indeed, a huge amount of energy had been wasted meaninglessly as the consequence of the unnecessary uses of street light [14, 15]. In Malaysia, due to the manually control of streetlights, there is notably electricity wasted as the lights are left ON without turning it off even though in day time. This happened because the low-reliability method and night street lighting is too bright and cancontribute to energy waste. The element in previous technologies has led to second-generation street lighting with the proper improvement, which implement the automation system [5, 9, 13]. As a result, the labour intensity and cost can be reduced as wells as improving efficiency. However, this new technology has drawback especially in intelligent management such as midnight night strategy, which has poor energy efficiency. The reduction in energy consumption results in significant saving on the town's energy costs.

II. PROPOSED SYSTEM

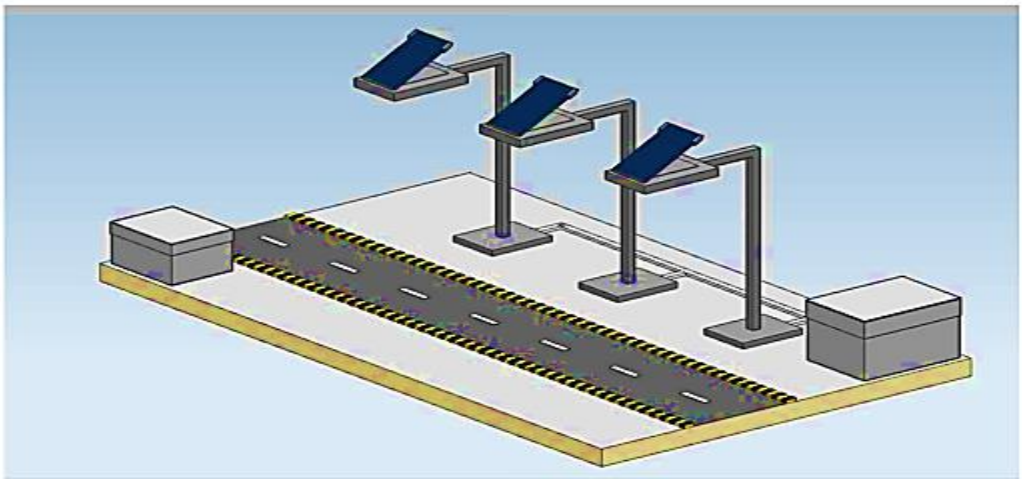

Fig. 1 Proposed model

The term 'smart street lighting' refers to street lighting that performs the role of traditional street lighting and additional features are designed to increase its efficiency, productivity and services. Smart Green Street Lighting System or also known as an intelligent street lighting system is a control system for street lighting that

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responds or react when there is a movement from pedestrians, cyclist and vehicles. In other words, smart street lighting system refers to an adaptive street lighting where it can dim when no activity is detected, but brighten when there is a movement detected by the sensor. “Sensor is the heart of the smart lighting [18]. The flowchart in Fig. 2 illustrates the research stages followed in the present study.

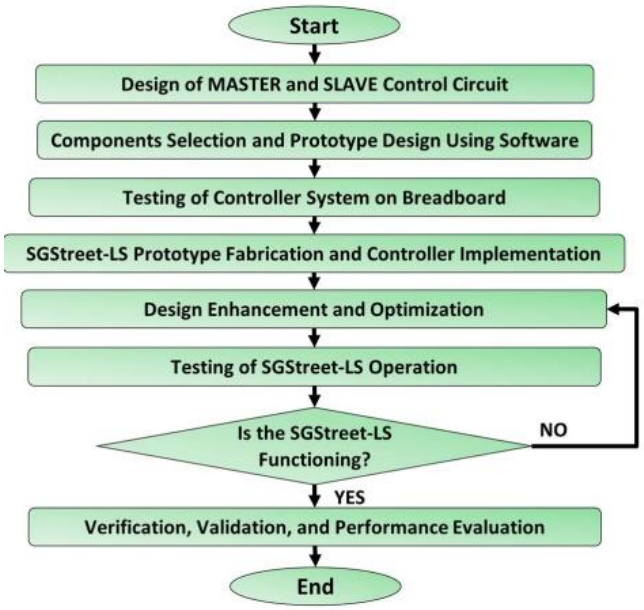

Fig. 2 Flowchart of research activities

In this section, the structure of the developed SG Street-LS will be presented along with the adopted methods for energy saving and utilization of renewable energy sources efficiently. Figure 3 presents a top overview of the developed prototype. The SG Street-LS uses LDR sensor together with PIR motion sensor that can detect the moving object and the light will switch on according to the movement of the object. These sensors will connect to Arduino microcontroller in the Slave circuit which processes the data and transmits to the Master circuit to control the light switching concept. Whenever the sensor identifies the passer, it will communicate to the neighbouring Master controller and switching ON the street light then it will assist the road user. The street light will turn OFF when no movement detected; thus, this system will play a significant role in saving the electricity without affecting the comfort zone.

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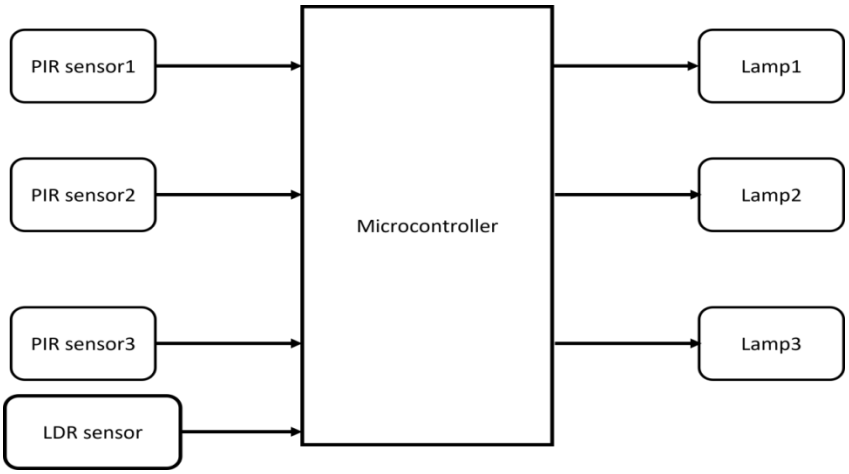

Fig3 block diagram of the project

For the simplicity of discussion, Fig. 3 illustrates the overall architecture for circuits and their components. As we can notice, the circuit includes PIR and LDR sensors to monitor motion and light intensity respectively. The two sensors are connected to two input ports of Arduino to update their data in real time
The circuit switches LED lights, which are supplied by solar panels, ON/OFF according to the received messages from the Slave circuit

III. CONCLUSION

Green Smart Street Lighting System is a cost effective, practical, eco-friendly and a safe way to save energy. A SG Street-LS with high degree of adaptability was developed in this paper. The system takes advantage of an energy saving strategy renewable energy utilization. Although the benefits of having such system in place are undeniable and clearly seen, many factors need to be taken into consideration before it can be fully implemented. The proposed system clearly tackles the two problems that the world is facing today (energy waste and pollution). Overall, it may be said, SG Street-LS saves energy and maintenance cost greenly and can reducing energy consumption up to 80%, thus cutting down the cost of electricity and lowering down the emission of CO2 to the atmosphere by utilizing renewable energy source

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