

Development of Light – Emitting Diode (LED) and Pyroelectric Infrared (PIR) Application at Road Corner

Norizan Binti Zakaria, Rozilaili Binti Mustapa & Nor Muslaili Binti Mokhtar

Jabatan Kejuruteraan Awam, Politeknik Sultan Idris Shah, Sungai Lang, 45100
Sungai Air Tawar, Selangor Darul Ehsan

nzcy_zan@yahoo.com

ABSTRACT

In the construction of road, there are some places of road corners especially at the rural area need a special. Road corner is blind spot for driver in order to ensure the other driver from other side. At this corner, the accidents always happen. Although the speed of the vehicles at this area also contribute to the accident. On the other hand, insufficient of the street light also can cause limitation of view to the driver to look at the chevron signboard. Due to these problems, an initiative of product has been conducted in order reduce the accident. A sensor to detect motion has been used and LED for lighting installed at the chevron. Motion sensor that used in this product is Pyroelectric Infrared Sensor (PIR) motion sensor that can detect intruder and sent an alert to the panel channel. Other components that have a potential and suitable in traffic engineering are Light-Emitting Diode (LED). This product will help to prevent an accident at corner during night or early morning especially for student, staff politeknik Sultan Idris Shah and community because the road corner at Jalan Sem 3, Kampung Sungai Apong Sungai Air tawar, Sabak Bernam are main road to Polytechnic. This product consists of Light Emitting Diode (LED), Pyroelectric Infrared Sensor (PIR), Lead Acid Battery 12v and Chevron Signboard. The function of LED is to give sign before entering corner road, while the function of PIR is to detect vehicle through the corner road. The combination between LED and PIR with Lead Acid Battery of 12v is able to generate power supply in order to detect the vehicle. This product was carried out to obtain data timing of the vehicles that passed through from the PIR sensor until the last chevron signboard and the result showed that distance 35m have an effective data for this testing where are the sensor can give an earlier signal to the Light-Emitting Diode (LED) to light up simultaneously can alert road user earlier. Next, the distance data collected by measured the distance of vehicles from the PIR sensor until a fixed time also obtained a distance 35 meter as a suitable distance to placing sensor. While the data for time to notice the signboard was collected by taken the time driver notice the first chevron signboard until it passed through the first chevron signboard , it found distance 35m have a result that vehicle slower compared to the other distance where the average time is 6.11 s without the LED and 7.29 s with the LED. This innovation is important to improve safety road system especially at the road corner to reduce the risk of accident and in educational aspect it can also help to provide additional idea to student for any improvement of road safety system in Malaysia.

Key Words: accidents, chevron, PIR sensor, LED, road corner

1. INTRODUCTION

Road corner was built to connect between two points of roads and road corner has become the blackspot area for accident happen. Blackspot area is a place where are the most frequent occurrence of accident. Accident happened especially at the road corner because of the speed of the vehicles are over the limit. Speed limit signboard have been placed on the side of the road to prevent the road user involved in an accident, but the are some road user willing to risk their life than follow the road rules. Other than that, insufficient of street light at the road corner usually at the rural area can cause accident happen. Therefore, signboard play as an important role to reduce the rate of accident at the road corner.

Signage played a big role in order to make sure the traffic under control. Recognizing and knowing road signs are part of the legal criteria for getting a driver license and are the key component in a driving theory test. So, the number of accident can also be decrease and road furniture exist to prevent and reduced the risk of the accident. A curved mirror, convex mirror and fish eye mirror is a

road furniture at road corner. This mirror is one of the safety warning provided with a curved reflecting surface. Besides that, a signboard of speed limit concluded as one of the safety warning at the corner of the road remind the driver to concern about their speed.

Chevron signboard on the road corner is one of the road traffic safety. Road traffic safety refers to the methods and measures used to prevent road users from being killed or seriously injured. Signboard has many types, colours and shape according to its function and message. Chevron is also a signboard that warns the road user to slow down their vehicle because of corner and important to every corner of the road for guide the road user especially at night or early morning when there are no light around the corner but still accident can happen. One of the function of signboard is to give caution or warning to the road users for safety purpose on what should or not should be done ahead. The function of chevron signboard is to reflect the light coming from vehicle to give a guide for the road user on the road corner especially at night. Although, there are chevron signboard, accident still occur and the risk of accident at the corner still high.

By using the traffic safety on the road, usage of sensor also suitable for road system improvement such as a speed trap. Speed trap application function with the help of motion sensor. This is one of the initiative that using motion sensor to reduce the rate of road accident. Other than that, sensor able to detect motion in any situation and condition. Motion sensor that used in this research is PIR motion sensor that can detect intruder and sent an alert to the panel channel. Other component have a potential and suitable in traffic engineering is Light-Emitting Diode (LED). So, a research about development Light-Emitting Diode (LED) with PIR Sensor application as an initiative to improve the road system at the road corner.

2. MATERIAL

The materials that will be used are the PIR Motion Sensor, Light-Emitting Diode strip (LED), Arduino and relay. While design the schematic diagram will produce using software Arduino for coding PIR motion sensor to detect movement the vehicle.

Development LED and PIR with Lead Acid Battery is able to generate power supply in order to detect the vehicle and has been applied at chevron signboard located at road corner. It is important for every person to have proper knowledge about these signs for safety purposes. This product was carried out to obtain data timing of the vehicles that passed through from the PIR sensor until the last chevron signboard. The testing was carried out at three (3) different distance in order to get an early signal. The sensor was installed at first distance that will give earlier signal to LED to light up simultaneously. LED light up give early signal to the road user and could improve the road traffic safety in order to reduce the rate of accident at the corner sight.

This innovation is produced in-house because the expertise and equipment used are from internal sources. Light-Emitting Diode (LED) Strip have characteristically low energy consumption, small size, longer lifetime and faster switching. Pyroelectric infrared sensor (PIR) sensor are small, inexpensive, low- power, easy to use and don't wear out and this product is easy for installation at road corner. The product was created between a (LED) and a (PIR) on the chevron signboard. LEDs that receive signals from PIR sensors will light up with the shape of the chevron arrow and this will help road users to start carefully and slow down the vehicle for early warnings about the presence of bends ahead.

To enhance the use of existing chevron signage, this innovative project has installed the LED and PIR sensor on the chevron signboard to help warn guards about turn bugs and dangerous. This product could be compare with existing chevron at road corner.

3. METHOD

The methods used to conduct this product to collect the necessary data and information, testing and application Light-Emitting Diode (LED) with PIR sensor on a road corner for the purpose of the effectiveness. The data collected will be analysed and conclusions will be made in order to get the differences the existing or with the innovation product. This research, will be undertaken to further enhance on the procedure, project development and project effectiveness.

Material preparation will be prepared for function light-emitting diode (LED) with PIR sensor. Then, the wire will be installed to connect the PIR Sensor with LED strips for development prototype PIR and LED. The PIR sensor will be covered with a box to protect the sensor for long lasting purpose and the Light-Emitting Diode (LED) strip will be attached at the chevron signboard placed on the side of the road. The prototype will be tested to determine the timing, distance and the timing to notice the

signboard. The test will be done at night where the LED strips can be seen clearly and three (3) different distance sensor to be placed at the road corner which are 20m, 35m, 45m. In order to achieve the objectives, the test will be conducted at the corner road and the driver while the drive will drive through this area. From testing comparison has been done without and with light-emitting diode (LED) with PIR sensor.

The application will be installed on the road corner at Jalan Bernam Sem 3, Kampung Sungai Apong, 45100 Sungai Air Tawar, Sabak Bernam, Selangor. The Light-Emitting Diode (LED) strip will be attached at the chevron signboard placed on the side of the road has three (3) chevron. The wire will be installed to connect the PIR Sensor with LED strips. The PIR sensor will be covered with a box to protect the sensor for long lasting purpose and have different distances. The installation process has been carried out for the purpose of testing to be made to get the data. After installation The Light-Emitting Diode (LED) are wrapped in plastic so do not enter the water.

4. RESULT AND DISCUSSION

Light-Emitting Diode (LED) with PIR Sensor is the main components used for this research. PIR Sensor will detect motion while LED will produce light after receive a signal from PIR Sensor. LED and PIR Sensor are combining by wiring system. Functions of both components are studied to be applying as one of road safety system especially at road corner. The combination of these two components is an initiative to help road user at road corner.

4.1 TIMING WITH AND WITHOUT LIGHT-EMITTING DIODE (LED) WITH PIR SENSOR

The result of Timing with and without Light-Emitting Diode (LED) with PIR Sensor In second shown in Table 1. The result was collecting from three difference distance for car and motorcycle. In distance 20m, the result 4.27 second for both with and without Light-Emitting Diode (LED) with PIR Sensor. While In distance 35m, the data reading is 4.67 second for timing with LED and 4.47 second timing without LED. Last for distance 45m timing with LED is 5.55 second and 5.64s for without Light- Emitting Diode (LED) with PIR Sensor.

Table 1: Result of Timing with and without Light-Emitting (LED) with PIR Sensor

Distance (m)	Timing With Light-Emitting Diode (LED) with PIR Sensor (s)	Timing Without Light-Emitting Diode (LED) with PIR Sensor (s)
20	4.27	4.27
35	4.67	4.47
45	5.55	5.64

4.2 COMPARISON OF TIMING WITHOUT AND WITH LIGHT-EMITTING DIODE (LED) WITH PIR SENSOR

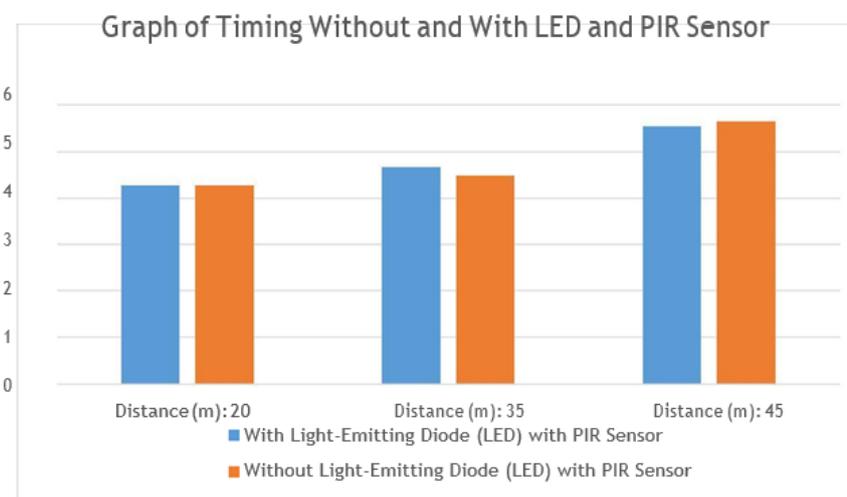


Figure 1: Analysis of Timing without and with Light-Emitting Diode (LED) with PIR Sensor

Comparison of timing without and with Light-Emitting Diode (LED) with PIR Sensor is shown in Figure 1. From graph show the higher timing from distance 45 m, so road user taking to through way at road corner to identify chevron signboard while for distance 20m to short timing. While for distance 35m is suitable for road user look chevron signboard at road corner.

4.3 DISTANCE WITHOUT AND WITH LIGHT-EMITTING DIODE (LED) WITH PIR SENSOR

Result of distance without and with Light-Emitting Diode (LED) with PIR Sensor for each distance is shown in Table 2. The lowest distance collected with Light-Emitting Diode (LED) with PIR Sensor is 28.53m while the highest distance is 38.75m. The result without Light-Emitting Diode (LED) with PIR Sensor shows the lowest distance is 21.75m while the highest is 33.12m. Result of distance from the sensor until a fixed time which is three second was measured by using walking road measurement. The distance measured to determine the suitable place for sensor location by refer from the average distance of a vehicle from the sensor.

Table 2: Result of Distance without and with Light-Emitting Diode (LED) with PIR Sensor

Distance (m)	Distance With Light-Emitting Diode (LED) with PIR Sensor (m)	Distance Without Light-Emitting Diode (LED) with PIR Sensor (m)
20	38.75	33.12
35	28.53	21.75
45	32.28	25.70

4.3 COMPARISON OF DISTANCE WITHOUT AND WITH LIGHT-EMITTING DIODE (LED) WITH PIR SENSOR

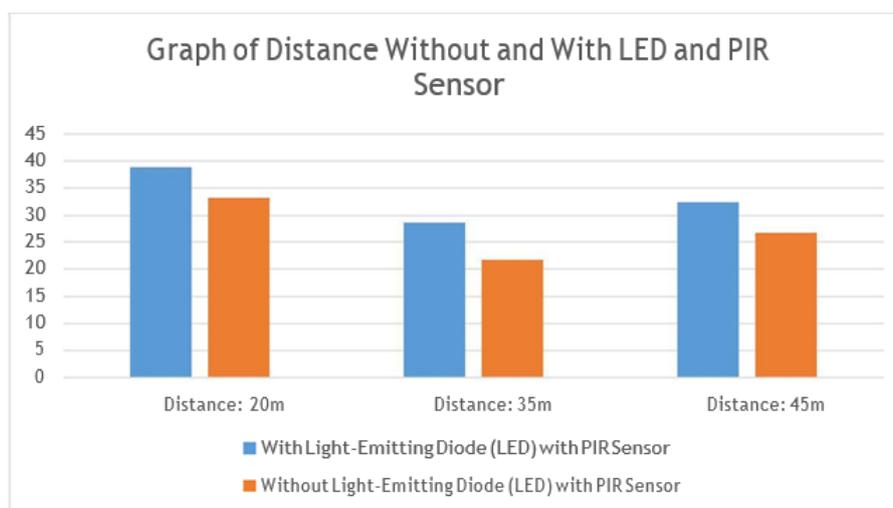


Figure 2: Analysis of Distance without and with Light-Emitting Diode (LED) with PIR Sensor

Analysis of distance without and with Light-Emitting Diode (LED) with PIR Sensor is shown in Figure 2. Bar graph above prepared from the result of distance without and with Light-Emitting Diode (LED) with PIR Sensor. All three bar graph showing that the data with Light-Emitting Diode (LED) with PIR Sensor is higher in every difference distances. There are three different distance which are distance 20m, distance 35m, and distance 45m away from first chevron signboard. Bar graph at distance 20m showing the result in with Light-Emitting Diode (LED) with PIR Sensor is 38.75m higher than without Light-Emitting Diode (LED) with PIR Sensor is 33.12m. In distance 35m, shows the data in with Light-Emitting Diode (LED) with PIR Sensor is 28.53m higher than without Light-Emitting Diode (LED) with PIR Sensor is 21.75m. Next, distance 45m showing the result in with Light-Emitting Diode (LED) with PIR Sensor is 32.28m higher than without Light-Emitting Diode (LED) with PIR Sensor is 25.70m.

4.4 TIMING TO NOTICE CHEVRON SIGNBOARD WITHOUT AND WITH LIGHT- EMITTING DIODE (LED) WITH PIR SENSOR

Result of timing to notice chevron signboard without and with Light-Emitting Diode (LED) with PIR Sensor shown in Table 3. The result of timing to notice signboard were collecting without and with Light-Emitting Diode (LED) with PIR Sensor. This testing required an individual to stay at first chevron as marking sign, a stopwatch to read a time in second and measuring tape to get a distance in metre. The result that been collected by each of the different station located. The result of timing to notice the signboard without Light- Emitting Diode (LED) with PIR Sensor in second. The result was collecting from three difference distance. In distance 20m, the highest data reading is 6.22s while the lowest data reading is 5.02s at distance 45m. while the result for timing to notice the signboard with Light-Emitting Diode (LED) with PIR Sensor In distance 35m, the highest data reading is 7.29s while the lowest data reading is 5.68 at distance 45m.

Table 3: Average Data of Timing to Notice Chevron Signboard without and with Light-Emitting Diode (LED) with PIR Sensor

Distance (m)	Distance to notice chevron signboard (m)	Timing to Notice With Light-Emitting Diode (LED) with PIR Sensor(s)	Timing to Notice Without Light-Emitting Diode (LED) with PIR Sensor (s)
20	76	6.73	6.22
35	79	7.29	6.11
45	69	5.68	5.02

4.5 COMPARISON OF TIMING TO NOTICE CHEVRON SIGNBOARD WITHOUT AND WITH LIGHT-EMITTING DIODE (LED) WITH PIR SENSOR

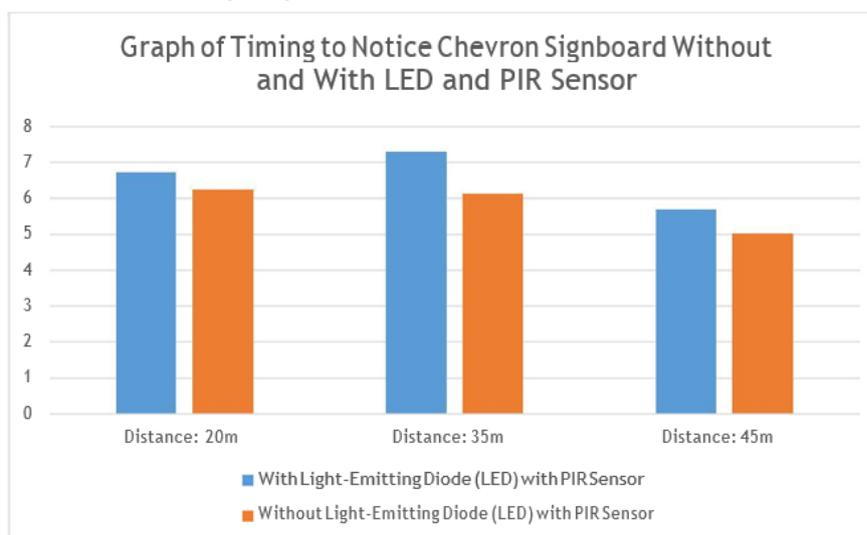


Figure 3: Analysis of Timing to Notice Chevron Signboard without and with Light-Emitting Diode (LED) with PIR Sensor

Figure 3 was creating based on result of timing to notice chevron signboard. From that can conclude that the timing to notice chevron signboard data with Light-Emitting Diode (LED) with PIR Sensor is higher compared to without Light-Emitting Diode (LED) with PIR Sensor. Bar graph at distance 20m with distance 76m showing the result in with Light-Emitting Diode (LED) with PIR Sensor is 6.73s higher than without Light-Emitting Diode (LED) with PIR Sensor is 6.22s. In distance 35m with distance 79m showing the result in with Light-Emitting Diode (LED) with PIR Sensor is 7.26s higher than without Light-Emitting Diode (LED) with PIR Sensor is 6.11s. Next, distance 45m with distance 69m showing the result in with Light-Emitting Diode (LED) with PIR Sensor is 5.68s higher than without Light-Emitting Diode (LED) with PIR Sensor is 5.02s.

5. SUMMARY

A research about development light-emitting diode (LED) with PIR sensor application at road corner has been done successfully with the objectives of this study have been attained. The installation of Light-Emitting Diode (LED) on the chevron signboard and placing the PIR sensor at distance 20 meter, 35 meter and 45 meter from the first chevron signboard have been done according the data needed to carry out in this research. Result has been collected to determine the relationship between the timing, distance and time notice the signboard with the application of Light-Emitting Diode (LED) and without the application. The data taken with the installation of the Light-Emitting Diode (LED) and PIR sensor to compare it with the data taken without the installation has been made. Result from the timing testing showed that distance which is the sensor at 35 meter from the first chevron is the suitable distance to placing the PIR sensor which has the most effective to slow down the vehicle with the data taken is 4.67

For the distance testing, the average distance measured for 35 meter from the first chevron has the most difference between all stations which are 21.75 m with the installation and 28.53 m without installation which mean the suitable distance to place the PIR sensor. Distance 35m showed the best result that vehicle slower compared to the other distance where the average time is 6.11 s without the LED and 7.29 s with the LED. From all the result taken shows that the vehicle is slower when the LED and PIR Sensor is installed on the chevron compared to the chevron without the LED and PIR Sensor. This can be concluded that the result of this research can reduce the danger especially at the road corner when usability of the chevron signboard is improved in order to give advantage to the road user to pass through the road corner safely.

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