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IoT BASED AUTOMATIC STREET LIGHT CONTROL AND FAULT DETECTION

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Abstract **-** The IoT (Internet of Things) is a booming technology that mainly concentrates on the interconnection of devices or components to one another and the people. As the time being, many of these connections are changing as Device to Device from Human to Device. Finding the faulty street light automatically is become a vital milestone by using this technology. The primary goal of the paper is to provide control and identification of the damaged street light automatically. Street light fault detector system informs to the concerned area electricity board substation when the street light is not functioning. Because of no proper street light, most of the thefts and accidents are happening. To avoid that sensors can be included in the light pole which sends the signal to the substation if the light is not functioning properly. Sensor sends the information like Area, Street, and Pole ID Number to the electricity substation. Lineman can easily identify the location from the substation and necessary measures can be taken immediately. Sensors added to identify whether the problem is with the solar light panel/ bulb or any difficulty in electricity distribution system. This approach helps for the lineman to work and fix it.
Keywords**:** Smart Street Light, Fault Detection Sensors, GPS, Arduino

I. INTRODUCTION

It is impossible to live without electricity as it is used in every field of life. Power system is known as generators that supply the power, transmission that carries the power from the generating centers to the load centers, and the distribution system. It includes conductors, capacitors and reactors SCADA systems (Supervisory control and data acquisition) which are used to control and monitor physical processes. The majority of these systems rely upon three phase AC power electric power is the product of two quantities: current and voltage. These two quantities can vary with respect to time (AC power) or can be kept at constant levels (DC power). Alternating current generators can produce a variable number of phases of power.

A higher number of phases leads to more efficient power system operation but also increases the infrastructure requirements of the system. Due to heavy voltage the electrical lines may get damaged. The lighting system which targets the energy and automatic operation on economical affordable for the streets and immediate information response about the street light fault. In general, the damage of the street light is observed by getting the complaints from the colony (street) people.

In the proposed system by using sensors these lights working status is easily captured without any manual intervention. It reduces the delay to fix problems. Automatic detection of whether the street light is working or not will be found at night time and sends the notification to the authorized person along with the location where the streetlight is damaged.

II. PROPOSED SYSTEM

This system includes smartness where if electrical lines are broken its location should be sent to the authorities automatically with the help of IoT technology without any human intervention. To modify the existing power distribution system for an automatic electrical line breakage detection and power supply breaking mechanism, a remote telemetry system is implemented in which RF transceivers are used to detect electrical line breakage. Also, the location where electrical line is broken will be sent to the authorities using GPS via IoT technology i.e., Wi-Fi along with the notification of SMS using

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Global System for Mobile communication (GSM). The switching of the electrical line will be done by the Relay. All components in the proposed system are controlled by the Arduino Microcontroller. Idea of the proposed system is that every pole is designed in such a way that it is connected to each other through wireless communication (RF-Radio Frequency modules). If there is no signal from a pole it sends message to the substation. It identifies whether the problem is in the bulb or there is any breakage of lines. The street lights are automatically switched ON/OFF using light-dependent resistor (LDR) sensor, based on the condition of the weather.

A. WORKING OF LIGHT DEPENDENT RESISTOR

The Light Dependent Resistor (LDR) is made from a piece of exposed semiconductor material such as cadmium sulphide that changes its electrical resistance from several thousand Ohms in the dark to only a few hundred Ohms when light falls upon it by creating hole-electron pairs in the material.

The net effect is an improvement in its conductivity with a decrease in resistance for an increase in illumination. Also, photo resistive cells have a long response time requiring many seconds to respond to a change in the light intensity. Materials used as the semiconductor substrate include, lead sulphide, lead selenide, indium antimonide which detect light in the infra-red range with the most commonly used of all photo resistive light sensors.

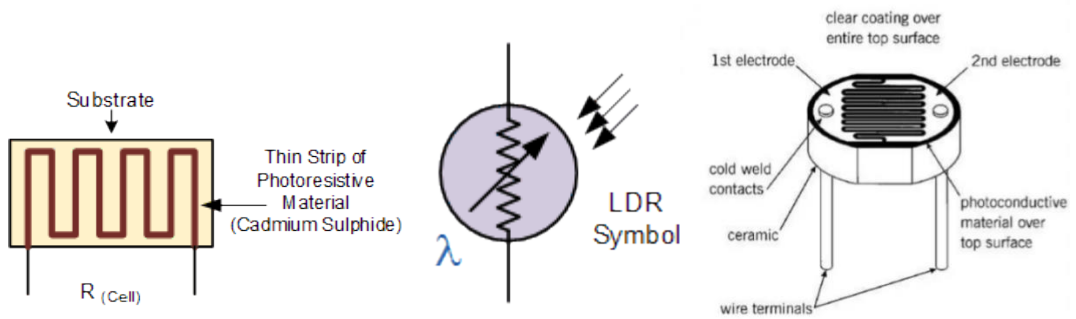

Fig 1: The Light Dependent Resistor Cell

The most commonly used photo resistive light sensor is the ORP12 (Oxidation reduction potential) Cadmium Sulphide (CdS) photoconductive cell. This light dependent resistor as shown in fig 1 , has a spectral response of about 610 nm in the yellow to orange region of light. The resistance of the cell when unilluminated (dark resistance) is very high at about 10MΩ's which falls to about 100Ω's when fully illuminated (lit resistance).

To increase the dark resistance and therefore reduce the dark current, the resistive path forms a zigzag pattern across the ceramic substrate. The CdS photocell is a very low cost device often used in auto dimming, darkness or twilight detection for turning the street lights "ON" and "OFF", and for photographic exposure meter type applications.

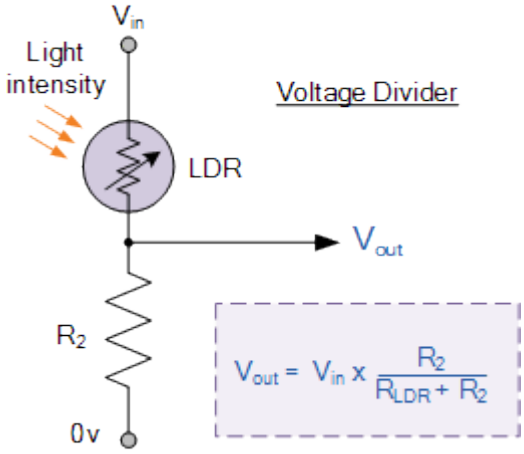

Fig 2 Voltage Divider

Connecting a light dependant resistor in series with a standard resistor like this across a single DC supply voltage has one major advantage, a different voltage will appear at their junction for different

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levels of light. The above fig 2 shows the voltage divider, the amount of voltage drop across series resistor, R_2 is determined by the resistive value of the light dependant resistor, R_{LDR}. This ability to generate different voltages produces a very handy circuit called a "Potential Divider" or Voltage Divider Network.

As we know, the current through a series circuit is common and as the LDR changes its resistive value due to the light intensity, the voltage present at V_{OUT} will be determined by the voltage divider formula. An LDR's resistance, R_{LDR} can vary from about 100Ω in the sun light, to over 10MΩ in absolute darkness with this variation of resistance being converted into a voltage variation at V_{OUT} as shown. One simple use of a *Light Dependent Resistor*, is as a light sensitive switch as shown in below fig 3.

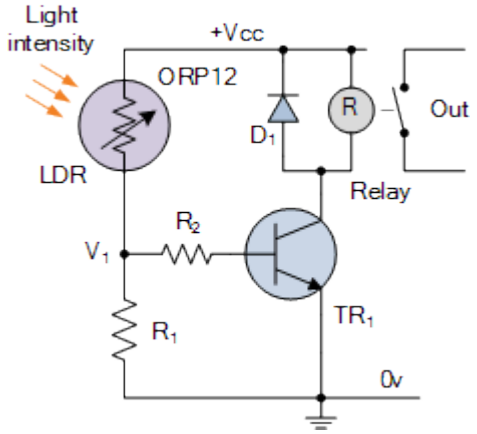

Fig 3 Circuit of Light Dependent Resistor

B. LDR SWITCH

This basic light sensor circuit is of a relay output light activated switch. A potential divider circuit is formed between the photo resistor, LDR and the resistor R_1. When no light is present it means, in darkness, the resistance of the LDR is very high in the Mega ohms (MΩ) range so zero base bias is applied to the transistor TR_1 and the relay is de-energised or "OFF".

As the light level increases the resistance of the LDR starts to decrease causing the base bias voltage at V_1 to rise. At some point determined by the potential divider network formed with resistor R_1, the base bias voltage is high enough to turn the transistor TR_1 "ON" and thus activate the relay which in turn is used to control some external circuitry. As the light level falls back to darkness again the resistance of the LDR increases causing the base voltage of the transistor to decrease, turning the transistor and relay "OFF" at a fixed light level determined again by the potential divider network.

By replacing the fixed resistor R_1 with a potentiometer VR_1, the point at which the relay turns "ON" or "OFF" can be pre-set to a particular light level. This type of simple circuit shown above has a fairly low sensitivity and its switching point may not be consistent due to variations in either temperature or the supply voltage.

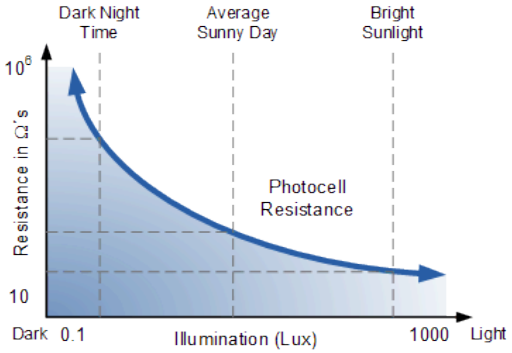

Fig 4 Photocell Resistance

The above fig 4 shows the working of LDR. During the dark night time the LDR emits the maximum light and during the bright sunlight it doesn't emits light from the LDR.

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C. DIGITAL MULTIMETER

A digital multimeter can be connected to the LDR to check the working condition of LDR as shown in the below fig 5. The resistance value will be displayed in the substation so that the lineman knows about the LDR. If there is no fault in the multimeter he can check the lines. The resistance value will change from different intensity of light in LDR.

Fig 5 Multimeter connected to LDR

Also it sends location of that area where there is a fault to the authorities through Geographical Positioning System (GPS).

D. MICRO CONTROLLER AND TRANSMITTER

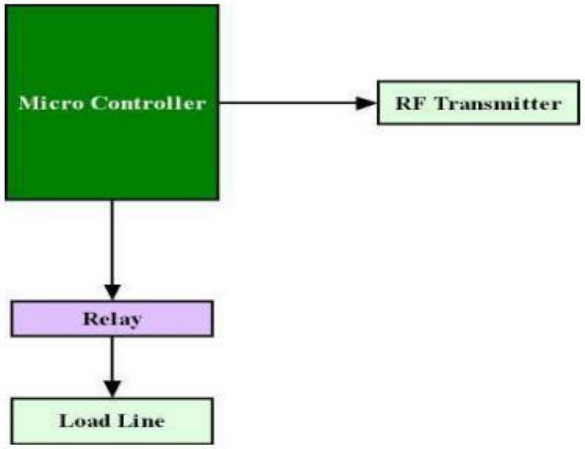

Fig 6 Micro Controller and Transmitter

In the transmitter part ,RF transmitter is connected to the Microcontroller for sending the data to the RF receiver and also a Relay is connected to the Microcontroller for switching ON and OFF the load line as shown in the above fig 6. At the receiver part it contains a Microcontroller, GPS, WiFi and GSM. The RF receiver receives the data sent from RF transmitter if that load line is not broken. When the load line gets broken, RF Transmitter won't send the data to the RF receiver. Then the receiver will actuate GSM to send the notification and actuates GPS to fetch the coordinates and that coordinates will be sent to the Wi-Fi module. Wi-Fi module is connected to the local network and using an IP address of that Wi-Fi module we can fetch the data of the coordinates through the web browser.

III. SYSTEM ARCHITECTURE

The following diagram shows the system Architecture of the proposed system.

Activity Area: It is the place where the components involved in the proposed system are implemented. It checks for electric line hazards and the status of the bulb and sends the SMS to authority substation.

Wi-Fi: It is an Internet of Thing (IoT) responsible in finding the Location of the occurred electrical line.

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Authority of Substation: Authority which is responsible in viewing and maintaining the confidentiality.
Internet: GPS location's activity area.
Line Man: Controls ON/OFF of the particular location's electrical line. Where, authority gets the SMS of the electrical line controlling.
Google Map: Map the location of the electrical hazard which can be viewed by the authority of substation.
Activity area sends the message about the electrical line breakage to the authority and the lineman where, authority can access the location via Wi-Fi module through the internet. Also, the message will be sent to the authority when the lineman tries to switch ON and OFF the electrical line.

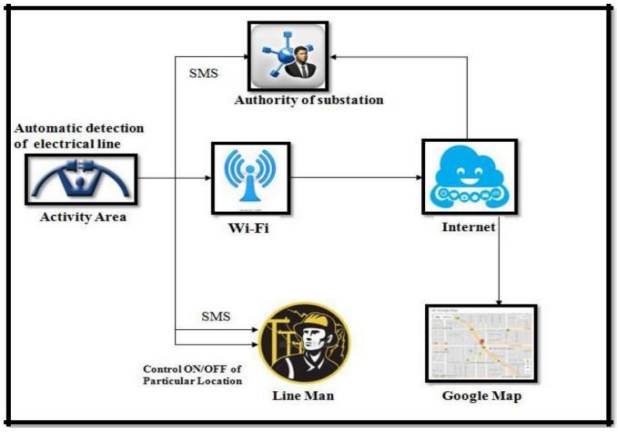

Fig 6 System Architecture of the Proposed System

IV. CONCLUSION

This paper discusses the usage of IoT in the lighting street lights to ON/OFF automatically based on the weather condition. The LDR sensor senses the environmental changes, to ON/OFF of the street lights is made automatically. Whenever the street light got damaged or not working during night time, the LDR sensor senses it and sends the notification to the authorized person that the light is damaged and the location (using GPS) where the light is damaged. It reduces human efforts, delays in fixing the issues.

V. REFERENCES

[1] Amey Manekar, J., Dr. Kshirsagar, Dr. R .V. (2016). " Design and Implementation of Automatic Street Light Controller for Energy Optimization Using FPGA", International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 6, June 2016.
[2] Sayali Arkade, Akshada Mohite, Rutuj, Vikas, "IoT Based Street Lights For Smart City" International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 4 Issue XII, December 2016.
[3] Lopes, J.P., deSouza, I.H., Gobbato, C., Denardin, G.W., Kohler, S.V. (2016). "Integrated topology of DC converter for street lighting system based on LED modular drivers", Industry Applications (INDUSCON), 12th IEEE International Conference
[4] Dr.K.Sathiyasekar, S.Sonika, S.Jaishree, "Intelligent accident identification system using GPS, GSM modem", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 3(2), 2014, ISSN (Online): 2278-1021. ISSN (Print): 2319-5940.
[5] Athira P Nair, Josephin J, Anjana A S, Athira C P, Sebin J Olickal, "Electric Line Man Safety System with OTP Based Circuit Breaker", IJRET: International Journal of Research in Engineering and Technology eISSN: 2319- 1163, pISSN: 2321-7308. Volume: 04 (03), INCEPTION-2015, Apr-2015.

DOI:10.46647/ijetms.2022.v06i05.133 ISSN: 2581-4621

[6] B.A. Jan, "Use of G.P.S in EHV Transmission Line Fault and Detection Transmission Line Protection in Power System", International Journal of Engineering Science Invention Research & Development. Vol. 1(10), 2015, e-ISSN: 2349-6185
[7] Ing. Komi Agbesi, Felix Attuquaye Okai, "Automatic Fault Detection and Location in Power Transmission Lines Using GSM Technology", International Journal of Advance Research in Science and Engineering. Vol.5 (01), 2016
[8] Mr. Pravinkumar N.Mahadik, Mr. Pratik A.Yadav, Mr. Suraj B. Ghotpagar, Harsha P. Pawar, Electric Line Man Safety using Micro Controller with GSM Module", IJSRD - International Journal for Scientific Research & Development, Vol. 4(01), 2016, ISSN (online): 2321-0613.
[9]Maniket S. Sonawane, V. N. Karande, "Power Line Conductor Breakage Accident Avoidance using Wireless Communication", International Journal of Electronics Communication and Computer Engineering Vol.5(4), Technovision-2014, ISSN 2249– 071X Technovision-2014: 1st International Conference at SITS, Narhe, Pune in 2014
[10] S. P. Raja and T. Dhiliphan Rajkumar, "Internet of Things: Challenges, Issues and Applications", Journal of Circuits, Systems, and Computers Vol. 27, No. 9, 2018, pp. 1-16.
[11] Sachin Datta, N S., Abdul Latif Saleem., Sachin, H S., Raja Sagar, R., and Usha, M, S. (2015) "Street Light Monitoring and Control System" International Journal of Engineering and Techniques - Volume 1 Issue2.