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Luciferin Intelligent Light Systems

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Abstract- The growing demands of energy have forced us to turn to alternate sources of energy or make better use of existing resources. Given the need of the hour, since it is difficult to find an energy resource that is truly sustainable, it would be better to make good use of existing resources. Our project dwells on conserving electricity by the means of controlling the intensity of lights in lighting system which are one of the prime devices concerned with electricity consumption .The project is applicable in two scenarios subway/corridor lighting system and room lighting system. Not only will our project save energy by regulating intensity but will be smart enough to respond to different stimuli i.e. day or night. Along the with energy conservation our project also focuses on providing basic security feature in case of intrusion detection. The security mechanism will controlled by wifi. The entire arrangement will be operated through an android app which makes the project smart and modern

***Keywords* — Security, Smart Light System, WIFI, LEDs, Sensors, Energy Conservation.**

I. INTRODUCTION

The human race from its very inception has survived on one or other form of energy. The gradual progress made over the years has made us dependent on energy for meeting our day to day needs as well as our existence. But the increasing over exploitation of resources has lead to a sharp crisis as far availability is concerned. This has in turn forced us to turn to alternate sources of energy or make efficient use of the existing resources. As there is still research and development of technology that can make use sustainable use of alternate energy sources, the immediate aim to tackle the problem must be to make efficient use of the existing resources and the aim of this project is to implement the same. Electricity consumption has been on par with ever increasing demand. But this has also lead to too much wastage which instead could be applied to alternate departments. Modern lights system are a major consumer of electric energy ,our project aims at developing a model which will ensure that the waste of energy in reduced to the least and the objective of existing system is also not compromised[1][3]. Traditionally used systems have studied and their characteristics analyzed for better understanding and application. Our system intends to make use of sensors, processing units and LEDS to design an apparatus that will save electricity. When needed this apparatus will work at full power i.e. but when not in use it will reduce to minimum of the total intensity [4]. Sensors will detect different scenarios and return an output correspondingly; the processing unit will then order the LEDs to react correspondingly. The entire apparatus will be enclosed within a case. According to the survey replacing the traditionally used Lighting systems with with LEDS will save energy by 52%. Apart from ensuring that energy saving is achieved, the use of LEDS also provide other benefits such as cost saving, durability, more performance and wide scale application all of which have been highlighted in references.

Also any modern smart system must focus on security as one of the basic requirement to be classified as smart. A wifi module has been integrated with the original setup to allow sending a message or making call over wifi to predetermined number. This arrangement works using inputs from the sensors as well code

A. Need

The growing demands of energy either have forced us to turn to sources that are truly sustainable or make efficient use of the existing energy resources which is sensible option as there aren't any sources that are truly sustainable e.g. nuclear energy has its own demerits, Wind energy requires large scale infrastructure and has low outputs. Therefore we decided to make a model that achieves the objective of conservation of energy, since energy saved is energy earned. Efficient use of energy not only results in saving but also makes energy available to other applications. Apart from monetary benefits, conservation is also aimed at reduction in pollution arising from energy generation e.g. energy generated from coal burning or nuclear disaster. The amount of energy generation can be reduced if some mount of energy is conserved from already generated values or proper analysis is done of the demand and subsequently the amount is produced with respect to the demand [2].

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II. BACKGROUND

LEDs have been taking to the streets since the 1990s, when cities throughout the U.S. and Europe began replacing incandescent-based traffic lights with highly energy-efficient solid state fixtures. Today's power LEDs are poised to cross the next municipal frontier and tackle the challenge of street lighting. If the mass adoption of solid state traffic signals is any indication, high pressure sodium, and high intensity discharge (mercury vapor) street lamps may soon lose their luster as the dominant sources of road and sidewalk illumination.

The first LED street light installations are already being tested around the world, and in some cases implemented, in China, North America and Europe, as governments, municipalities and utilities strive to replicate the energy and maintenance savings of LED traffic lights elsewhere within their borders [5].

With a 10- to 15-year lifetime that is at least triple that of current technologies, the maintenance advantages alone offer a street-smart argument for transitioning to LED-based systems. When we consider the design flexibility and sustainability afforded by LED-based systems, the case for solid-state street lighting is compelling.

LED solutions offer energy savings of as much as 50%, other 'green' features are mercury-free construction, and reduced light pollution made possible by the ability to precisely control light direction through LED placement and optics optimization. Moreover, street lamps using today's power LEDs are fully capable of meeting standard regulations for luminance levels and uniformity. LED solutions, unlike many other technologies, provide a sufficiently even light distribution (as shown in Figure 2) to meet recommended street light uniformity levels [6] [7]. This is a valuable benefit that is capable of eliminating glare, hot spots and related visibility, safety and energy wasting problems. Even light distribution improves the street lighting function and creates a better environment for people[8][9].

All of these factors add up to make solid state street luminaries a bright idea.

A. Design

To examine the performance benefits of using LEDs for street lamp illumination, let's look at a demonstration lamp built with LUXEON Rebel LEDs .In this design, 50 cool white (6500K) LEDs are placed in rows and installed at varying angles to achieve the desired light coverage. Each LED is driven at 350mA, has a light output of roughly 90 lumens, and uses a secondary collimating optic for maximum efficiency and uniformity

This configuration was designed to comply with European specifications for residential and city center street lighting, including average luminance levels and overall luminance uniformity, while also minimizing the number of LEDs required and saving energy over conventional light sources

All of the European benchmarks were reached and in some cases exceeded, proving that today's power LEDs are not only appropriate but superior for many pedestrian and street lighting solutions.

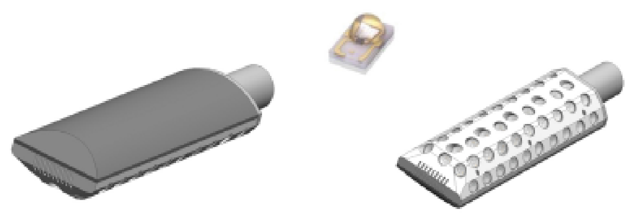

Fig.1 LUXEON Rebel LEDs

In addition, the demonstration design produced an LED junction temperature of 62°C, well within the range required to achieve the 60,000-hour life expectancy of the LUXEON Rebel LEDs used in the model.

The LUXEON Rebel was chosen for demonstration purposes because of its ultra-small footprint (75% smaller than other surface mount power LEDs), high operating junction temperature, leading lumen performance and 60,000-hour lifetime, drive current range of 350mA to 1000mA, and availability of cool, neutral and warm white options for varying street light environments. The small size and form factor of the package enabled maximum light and packing density as well as exceptionally tight coupling of the optic to the LED — both critical factors in achieving desired luminance levels while also minimizing flux loss caused by diffraction of light through the optical lens. What follows is a discussion of the comparative performance of the sample LED

Street lamps against those built with the present street light technologies, plus a look at additional benefits that are expected to spur a movement toward power LEDs in street lighting [10].

B. Performance Benefits

The chart below shows how the solid-state street light demonstration design produced with LUXEON Rebel LEDs stacks up against the two dominant lighting technologies used for street lighting.

The performance benefits of the LED scenario are striking. Highlights include:

• Lower power consumption (67W) slashing energy use by 52% over Mercury Vapor (138W) and 26% over a high pressure sodium fixture (90W)

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• Higher efficacy (50 lm/W) far exceeding mercury vapor's 31 lm/W and again contributing to energy savings.

— The higher efficacy measurement for high pressure sodium lamps is misleading because it includes wasted light that in turn wastes energy, as described below.

	LUXEON REBEL	HIGH PRESSURE SODIUM	MERCURY VAPOR
Flux (lm)	3325	5510	4340
Power consumption	67W	90W	138W
System Efficacy (lm/W)	50	61 *	31
Average lux	14	19	14
Utilization	0.0042	0.0034	0.0032
Lux/W	0.21	0.21 **	0.10
Min/avg lux ratio	0.40	0.32	0.23
Lifetime (hours)	60,000	20,000 to 30,000	6,000 to 10,000

Table 1 Comparison

• More lux per watt (0.21) more than double that of a mercury vapor street lamp.

— The LED-equivalent measurement for high pressure sodium lamps is skewed by hot spots that bump up the lux rating but cause undesirable visibility, safety and glare problems.

• More even light distribution (0.40) than either of the other alternatives, as indicated by the ratio between the minimum and average lux produced in the target zone. The LED scenario was the only one of the three to match the European street lighting guidelines on this uniformity measure because of its ability to precisely direct light (see Figure 5.4).

• Longer lifetime (60,000 hours) translates into a 10- to 15-year life expectancy, depending on the duration of darkness in the specific geographic location. In contrast, conventional street lamps burn out after three to five years, incurring higher manpower and related maintenance costs for bulb replacement.

Lower Total Cost of Ownership:

Beyond performance, one of the most compelling arguments in favor of LED street lamps is the cost advantage of operating and maintaining the fixtures. In part, this comes from reduced energy usage that can cut electricity bills in half. In part, it comes from the longer replacement cycle made possible by longer LED life. Increasing the interval between bulb replacements from three to five years to 10 or 15 means fewer truck runs, less fuel, and less overhead for work crews.

This in turn accelerates the return on investment. Even with the higher initial cost of a solid state luminaire, municipalities can recoup the costs of an LED-based street lighting installation in four to six years (The ROI will be even faster as power costs increase and technology advances increase LED light output, making it possible to deliver more lumens per watt for additional energy savings.

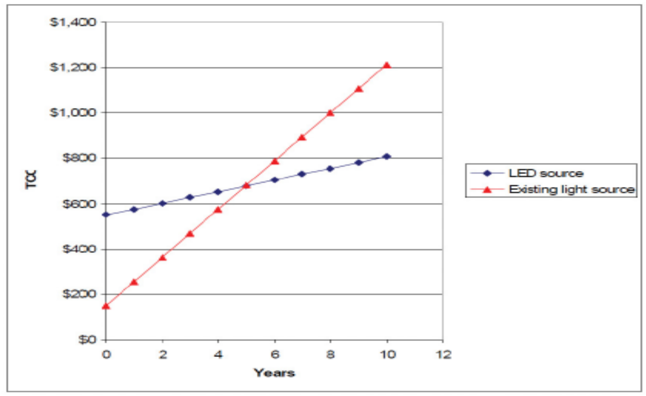

Fig. 2 Estimated payback times.

Reduced Light Pollution:

Another virtue of LED-based street lighting is the ability to all but eliminate hot spots and wasted light. This degree of control over the light distribution — a byproduct of the LED form factor itself — not only improves safety and visibility but also reduces the lumen requirements of the luminaire. Consequently, the use of LEDs delivers energy savings above and beyond that made possible by their low power demands.

A traditional filament emits light from a single source. Shields, reflectors and/or lenses are used to point the beam in the desired direction, but engineers have limited control. Some light spills over to neighboring buildings or bounces skyward (wasting energy and creating light pollution), the light is brighter in the middle and dimmer at the edges, and the light concentration in the center creates hot spots that can cause eye strain for drivers and pedestrians.

In contrast, the small LED package allows the use of multiple light sources with individual optics. Each LED can be targeted to a specific area or position, providing more uniform coverage as well as eliminating central hot spots and glare. It's like the difference between having a single massive spotlight pointed at a stage and aiming multiple smaller spots at strategic locations.

Low Environmental Impact:

The use of LEDs for solid-state street lamps also provides a variety of sustainability benefits that facilitate compliance with 'green' initiatives. Among them:

• Low LED power consumption yields energy savings of 20% to 50% over high pressure sodium and mercury vapor street luminaries at today's levels, as indicated earlier. This energy efficiency is expected to increase with ongoing advances in solid state technology.

• LEDs' ability to minimize wasted light lowers power demands even further by reducing the lumen requirements for

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a given street fixture. Since light distribution can be controlled on an LED-by-LED basis, engineers can effectively light the target zone without the light pollution created by a single-beam solution.

• Mercury-free LED construction makes solid state street lamps safe for landfills while also complying with mercury bans such as the European Union's RoHS directive.

• Long LED life lengthens replacement cycles and associated fuel usage by maintenance crews, while also extending fixture life and thereby reducing the burden on the waste stream.

• LED street lights reduce pollution and carbon footprint via energy savings that lowers carbon dioxide and mercury emissions from coal-burning plants, as well as reduced fuel consumption by maintenance crews dispatched for bulb replacement.

III. PRESENT INVESTIGATION

3.1 Arduino Processing Unit

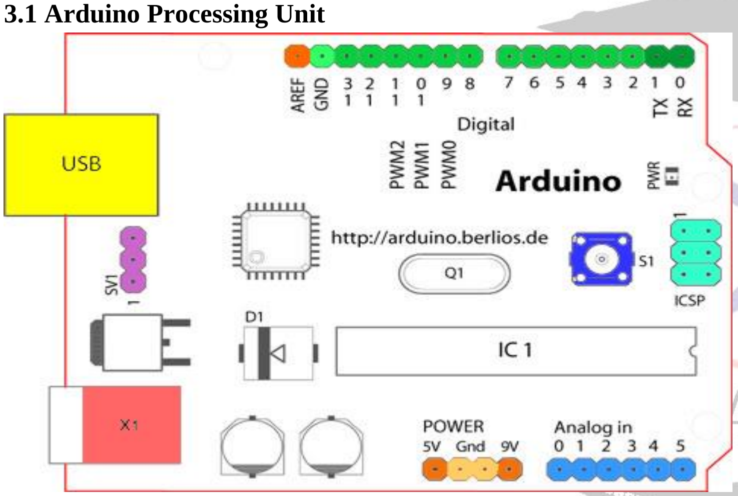

Fig.3 Arduino Board

The processing unit used for our project is the Arduino Uno which has the following pin configuration:

Analog Reference pin (orange)

Digital Ground (light green)

Digital Pins 2-13 (green)

Digital Pins 0-1/Serial In/Out – TX/RX (dark green) – These pins cannot be used for digital i/o (digital Read and digital Write) if you are also using serial communication (e.g. Serial.begin).

Reset Button – S1 (dark blue)

In-circuit Serial Programmer (blue-green)

Analog In Pins 0-5 (light blue)

- Power and Ground Pins (power: orange, grounds: light orange)
- External Power Supply In (9-12VDC) – X1 (pink)
- Toggles External Power and USB Power (place jumper on two pins closest to desired supply) – SV1 (purple)
- USB (used for uploading sketches to the board and for serial communication between the board and the computer;
- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. On the Arduino Diecimila, these pins are connected to the corresponding pins of the FTDI USB-TTL Serial chip. On the Arduino BT, they are connected to the corresponding pins of the WT11 Bluetooth module. On the Arduino Mini and LilyPad Arduino, they are intended for use with an external TTL serial module (e.g. the Mini-USB Adapter).
- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite () function. On boards with an Atmega8, PWM output is available only on pins 9, 10, and 11.
- BT Reset: 7. (Arduino BT-only) Connected to the reset line of the Bluetooth module.
- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.
- LED: 13. On the Diecimila and LilyPad, there is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- LEDS
- The two terminals of the LED are connected to the Arduino which provides it with the necessary input so that it glow.

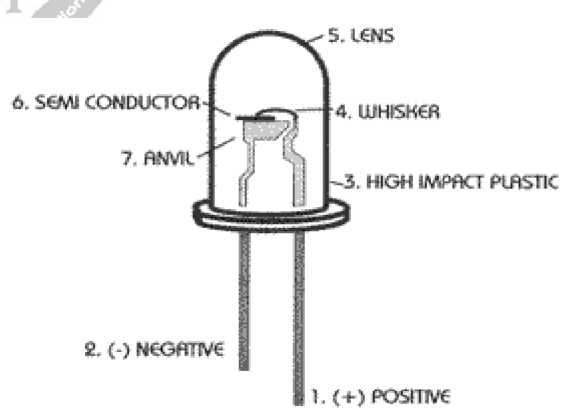

Fig. 4 Basic diagram of LED

- PIR Sensor
- PIRs are basically made of a pyroelectic sensor (which you can see above as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. Along with the pyroelectic sensor is a bunch of supporting

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circuitry, resistors and capacitors. It seems that most small hobbyist sensors use the BISS0001 ("Micro Power PIR Motion Detector IC"). This chip takes the output of the sensor and does some minor processing on it to emit a digital output pulse from the analog sensor.

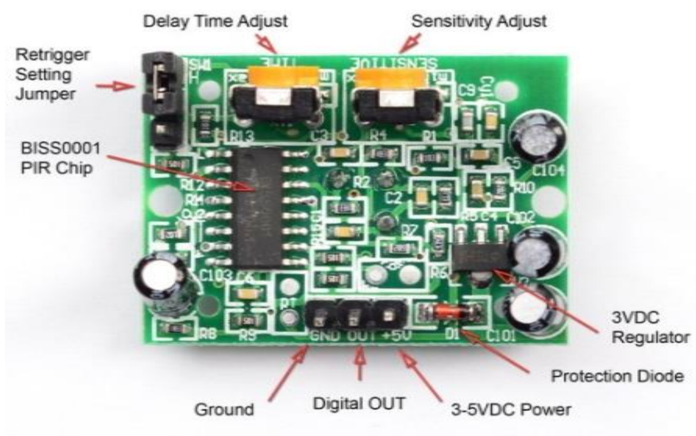
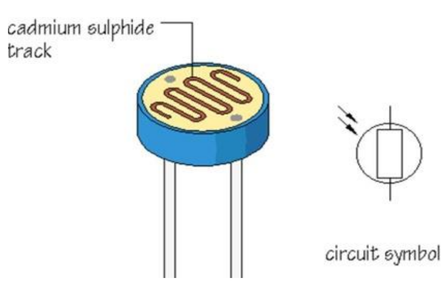


Fig. 5 Basic diagram of PIR sensors

- Output: Digital pulse high (3V) when triggered (motion detected) digital low when Idle (no motion detected). Pulse lengths are determined by resistors and capacitors on the PCB and differ from sensor to sensor.
- Sensitivity range: up to 20 feet (6 meters) 110° x 70° detection range
- Power supply: 3V-9V input voltage, but 5V is ideal
- Light Dependent Resistor (LDR)
- Light Dependent Resistor reacts to the intensity of light reacts correspondingly by sending and output which is connected to the Arduino



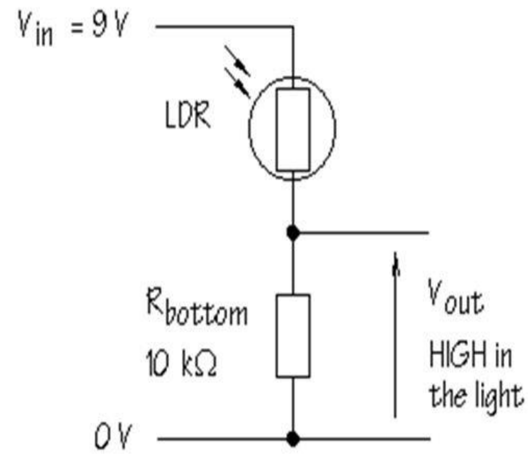


Fig.6 Basic diagram of LDR

- Vout becomes HIGH when the LDR is in the light, and LOW when the LDR is in the shade. Substitute the appropriate values in the voltage divider formula to convince yourself that this is true.
- GSM 900
- SIM900 Quad-band/SIM900A Dual-band GSM/GPRS module. It can communicate with controllers via AT commands (GSM 07.07, 07.05 and SIMCOM enhanced AT Commands). This module supports software power on and reset.
- Quad-Band 850/ 900/ 1800/ 1900 MHz
- Dual-Band 900/ 1900 MHz
- GPRS multi-slot class 10/8GPRS mobile station class B
- Compliant to GSM phase 2/2+Class 4 (2 W @850/ 900 MHz)
- Class 1 (1 W @ 1800/1900MHz)
- Control via AT commands (GSM 07.07 ,07.05 and SIMCOM enhanced AT Commands)
- Low power consumption: 1.5mA(sleep mode)
- Operation temperature: -40°C to +85 °C

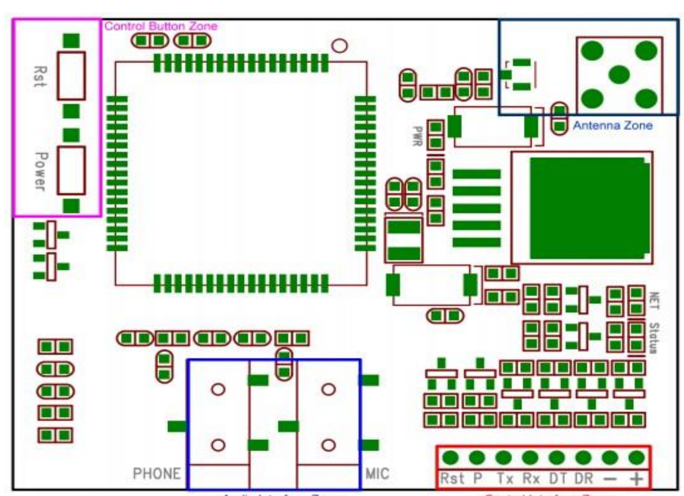


Figure 1 Top Map

Fig. 7 GSM900 Pin configuration

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PIN CONFIGURATION

Rst	1	Reset
P	2	Power switch
Tx	3	UART data output
Rx	4	UART data input
DT	5	Debug UART data output
DR	6	Debug UART data input
-	7	GND
+	8	VCC

Table 2 GSM900 Pin configuration

ETHERNET SHIELD

- W5100 Ethernet shield V1.0 is a WIZ net W5100 breakout board with POE and Micro-SD designed for Arduino platform. 5V/3.3V compatible operation voltage level makes it compatible with Arduino boards, leaf maple, and other Arduino compatible boards except Mega boards.
- FEATURES
- With Micro SD interface
- 5V/3.3V double operational voltage level
- 10Mb/100Mb Ethernet socket with POE
- All electronic brick interface are broken out
- Operation temperature: -40℃ ~ +85℃

BASIC PIN CONFIGURATION

D0	RX/Breakout
D1	TX/Breakout
D4	SD_CS
D9	W5100_Reset
D10	W5100_CS

Table 3 W5100 Ethernet shield Pin configuration

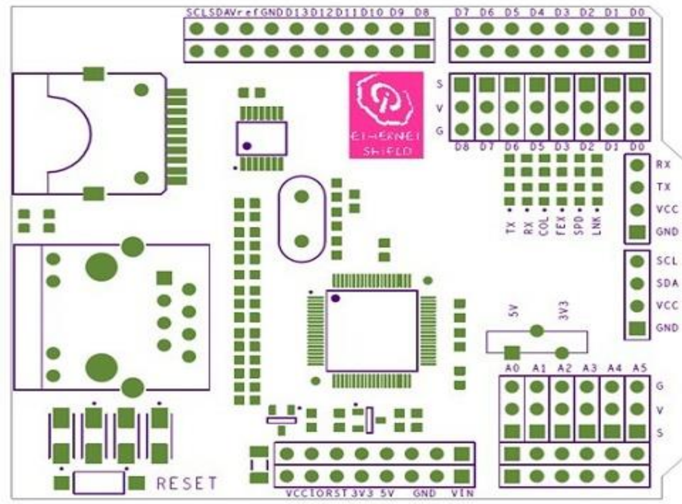

Fig. 8 W5100 Ethernet shield and its Pin configuration

3.2 METHODOLOGY

The first step would be to design LDR circuit using breadboard, LDR, resistors, wire and Arduino. GND, 5V and A0 pins of Arduino is used for connection. A0 pin convert the analog signal to digital and send the output to the LED to glow if resistance is increases. Resistors are used to adjust the value of LDR.

The next step would be to design the Sensor circuit. It will require PIR sensors and wires. It will be connected by 3 pins of Arduino 5v, GND and D2 pin which is digital pin. It will produce the PWM signals which will be given to the LED to adjust the intensity of it. This circuit also will be created on breadboard.

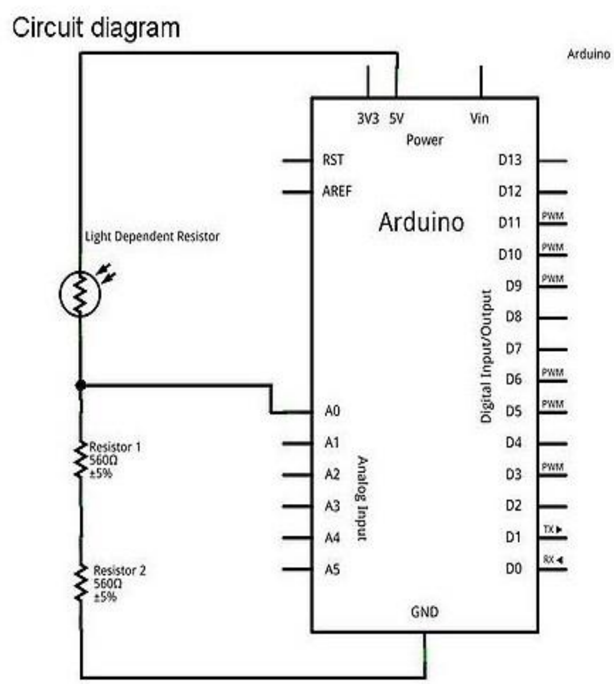

Fig.9 Interfacing LDR with Arduino

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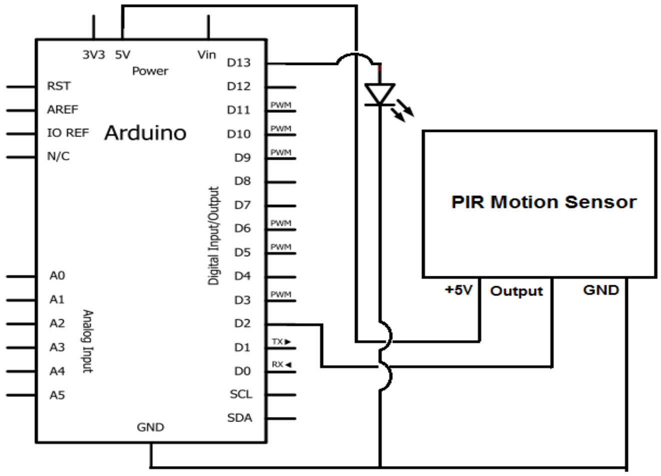

Fig. 10 Interfacing PIR sensor with Arduino

Led is always connected on 13 pin of digital pins of Arduino because it has in built function for LED.

The final circuit diagram for interfacing both the LDR along with the PIR motion sensors with Arduino is shown below

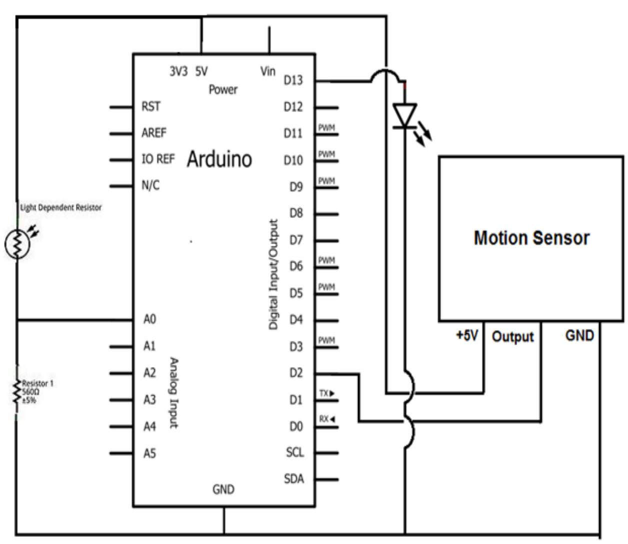

Fig. 11 Integrated circuit diagram.

In this paper includes a security mechanism which is implemented through a GSM900 module. A SIM card is used by the GSM900 to make a call or send a message over wifi to predetermined number. The mode of operation of the GSM900 is selected by means of an app which allows the user to select different modes depending upon the operations. In order to run the app the arduino needs to be assigned an IP address and in order to have an IP address we have fixed W5100 Ethernet shield to the arduino. The W5100 Ethernet Shield is then connected to a router which searches for IP address and then assigns it to the arduino. The arduino then sends a command to the GSM900 to make a call or send a message to fixed number. Therefore the final circuit diagram in addition to the previous circuit is

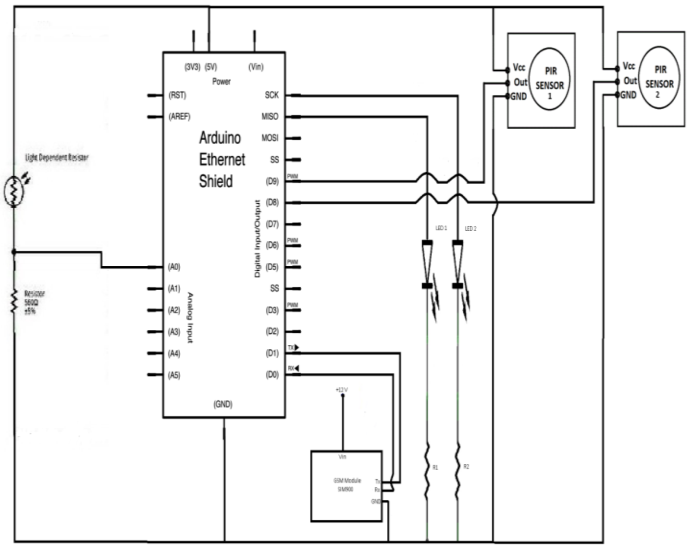

Fig. 12 Final Circuit Diagram

The overall flow of project is described as follows;

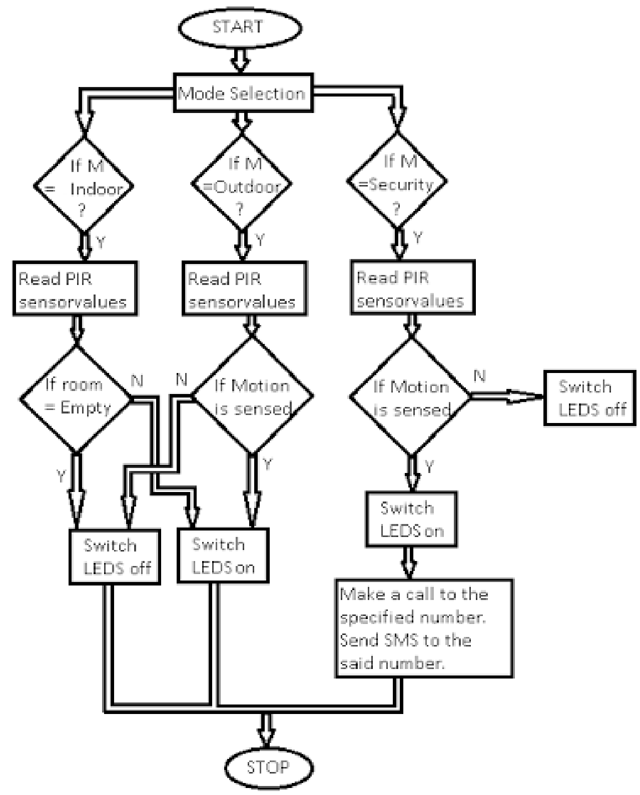

Fig. 13 Final Flowchart

Depending on the mode of operation selection using the app. In daytime lights will be off when resistance of LDR is low. As sun sets, sunlight will fade due to which resistance of LDR will increase which will command the LED to glow.

When LED will glow, it will glow to its Max intensity. If any movements are detected then sensor will give input to Arduino which will produce the PWM signals which are given to LEDS to glow to MAX intensity.

If object has passed the sensor, the LEDs will again switch off.

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In the morning, as the light fall on the LDR, the resistance of LDR will increase which will automatically switch off the LEDS.

In the security mode after detecting the PIR values, if motion is sensed the LEDs are switched on and a call is made and the message is sent to a fixed number using the GSM900.

IV. RESULTS AND DISCUSSION

In our attempts to conserve energy by making efficient use of the it we have designed an apparatus which has shown that its more than capable of saving energy and achieving this objective. The comparison of values of LED output as studied and highlighted in earlier chapter show the effectiveness it has achieved in comparison to traditional lighting systems. The study of the different sensors used such as PIR and LDR allowed us to make better use of them .The values in terms, of their output, provided by them, was used by the arduino processing unit to make better decisions. The overall analysis of LEDs has given tit an upper hand as compared combined with with all the sensors it has made it possible to achieve the objective of saving energy achievable. The wifi module comprising of GSM900 and W5100 Ethernet shield have made it possible to make calls and send messages. All these results have been specified in the screenshot given below.

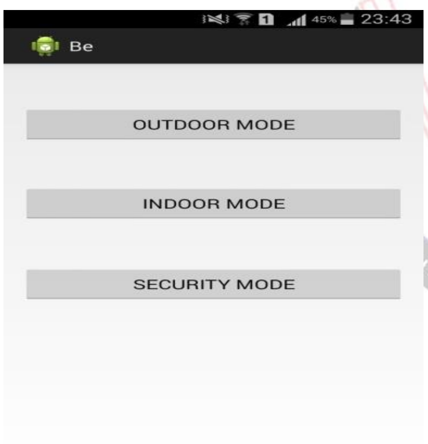

Fig. 14 Screenshot of the App

V. CONCLUSION

The main objective of designing this apparatus was to make efficient use of energy by saving it at the same time provide basic security mechanism. The study of sensors such as PIR, LDR have allowed us to understand their working then apply them in and efficient and useful manner for our apparatus. Their values have been studied and analyzed according to the environment we were working in and subsequently the code has been modified to adjust to those values. The Arduino processing unit has shown that it's more than capable of carrying out processing actions such as receiving inputs from LDR and PIR and then comparing their outputs. The coding language provided by Arduino has made it possible to create complex code with much ease then apply the values of different sensors in the comparison process to carry out the decision making. The security mechanism has been handled by the GSM900 WIFI module which has made it possible to make calls or send text over wifi to a fixed. All these action have been controlled by an android app which makes the system all together smart. In the app we have provided three basic modes of operation which allow the \user the decide depending upon his requirements.

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