# A Review on Design and Implementation of Light Energy Dimming System

A.S.Thakur[1], J.S.Deotale[2]

Assistant Professor, Dept. of ECE, Ballarpur Institute of Technology, Ballarpur, Maharashtra, India[1]

PG Student, Dept. of ECE, Ballarpur Institute of Technology, Ballarpur, Maharashtra, India[2]

**ABSTRACT**: This paper gives answer for light vitality darkening framework, as far as a vitality effective framework. The darkening levels of machines are tuned with enhanced ARM controller. A genuine equipment model is produced to control parameter-light force. The tuning parameters of ARM controller are figured with the assistance of general exchange capacity of the framework. Molecule Swarm Optimization calculation is utilized to advance the tuning parameters for ARM and results demonstrates more vitality effectiveness with proposed framework, when contrasted with regular frameworks. Diminishing execution has not been a revealed perspective for effectiveness appraisals before, however given the effect a dimmer has on a light, more idea and exertion should be put into institutionalizing dimmer similarity and giving the buyer a desire of execution. This paper conveys data to utility and industry members on the significance of guaranteeing similarity of combined light and dimmers.

**KEYWORDS:** Energy Efficient, ARM Controller, Light.

## I.INTRODUCTION

Today, hardware is utilized as a part of home machines for applications as generally fluctuating as darkening of a light. This development has expanded pace quickly on the grounds that machines require upgraded highlights that are anything but difficult to construct and change while gadgets based arrangements end up noticeably less expensive and more complex. Inside this advancement, ARM microcontrollers (MCU) dynamically supplant simple controller's discrete arrangements even in minimal effort applications. MCUs are more adaptable, regularly require less segments and give shorter time to advertise.

We as a whole realize what an AC dimmer is; for the individuals who don't, it's a sort of a circuit which can control the measure of AC voltage to be given to any gadget. You can see them in a fan controller or a light dimmer switch. In any case, have you at any point pondered of applying a similar idea of controllers/dimmers utilizing a microcontroller? On the off chance that you haven't, don't stress, this paper manages a similar stuff. Most importantly we have to comprehend the significance of a triac in such circuits. A triac is a 3 terminal gadget which can control the measure of AC current going through it. This can be accomplished by applying variable AC potential at its Gate stick. In our typical controller switches, this errand is accomplished by utilizing a potentiometer. Yet, with regards to carefully taking care of this circumstance, potentiometer isn't a decent decision. Here come these opto-couplers and opto-isolators in real life. They turn into a kind of an extension amongst AC and Digital segments. One more imperative term that I ought to have presented before is Zero Crossing Detection. This is likewise imperative while carefully controlling the dimmer circuit.

Control diminishing from Parallel info or Serial Data input. The control part is completely detached from high voltage by on board opto-couplers. This board is particularly change over our prior 16 stage board permitting more smooth control in diminishing because of more strides. The board can be utilized as a part of uses where darkening of 110-220V AC control is required like diminishing of resistive loads and light inductive load (like roof fan, Do not attempt to utilize it with substantial burdens like AC, Motors, halogen, transformers). The info can be basic 8 bit double flag from microcontroller which is segregated with the utilization of opto-couplers or serial information input. Aggregate of 256 levels of energy control can be set from absolutely off(0%) to full on(100%) according to enter control levels.
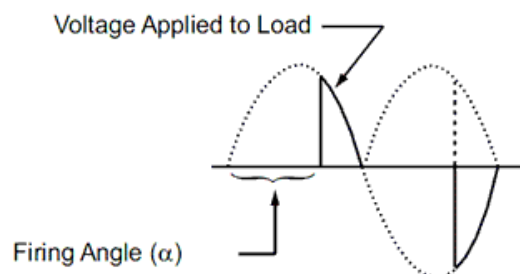
Elements
• AC Phase Angle Control Dimming
• Simple to use with any microcontrollers
• Output can switch on AC Load upto 12 Amp
• Output is optically secluded from input

**Specification**

| Parameter | Pin |
|---|---|
| AC Input | 80V AC to 250V AC |
| AC Load Current | 12 Amp Maximum |
| AC Load Type | Bulb (Resistive Load) up to 1000 Watts Fan (Inductive Load) upto 100 Watts |
| Frequency of mains | 50 Hz or 60 Hz |
| Control Input Voltage | 5V DC Isolated |

Theory of Operation
In this dimmer, the alternating current (AC) phase control method is used to control the intensity of an incandescent lamp or fan, which is connected as a load. The rms value of the voltage supplied to the lamp is varied by controlling the firing angle of a Triac. The firing angle is the time the Triac is made on. The firing angle is determined by the control input. By controlling the firing angle, the rms voltage supplied to the load changes and according to the voltage light intensity of the bulb varies. Figure displays the effective voltage applied to a load by controlling the firing angle, α.



Controlling Input - Parallel method
The input to board is simple 8 bit binary input of HIGH/LOW signal from microcontroller. There are eight inputs to board D0-D7. Each data control line needs to be now made either HIGH or LOW as per dimming required. The binary input is inverted. All parallel inputs have internal pull high. So if kept floating they all have value of 0xFF(255) which is off level. If full level is required all inputs are to be pulled low 0x00(0). you can then input any binary signal from 0x00 to 0xFF(0-255 decimal) to control the dimming. Ground signal has to be common with external control board along with parallel inputs.
Controlling Input - Serial method
The input to board is simple one byte character from microcontroller or PC. If byte 0 is sent then dimming is off, if byte 0xFF is sent it gives full level of brightness. Anything in between 0x00 to 0xFF is sent then it gives different levels of dimming. Ground signal has to be common with external control board along with parallel inputs. While controlling with serial method, keep all D0-D7 pins floating, Do not use it. If any pin from parallel is kept at low level then Serial inputs will be ignored.

## II.LITERATURE SURVEY

A lot of research work have been done in order to develop smart home management systems and efficient energy management systems. Jaeseok Yun, Member, and Min Hwan Son[1] present a novel method of detecting a relative direction of human movement (in eight directions uniformly distributed) with two pairs of PIR sensors whose sensing

elements are orthogonally aligned. piezoelectric infrared (PIR) sensors have been widely employed for human tracking system due to its low price and energy requirement, reduced form factor, and unobtrusive and privacy preserving interaction. Many research projects have developed many applications using occupancy detection and localization technology based on simple presence detection of a dense array of PIR sensors. However, beyond simple people presence, the output of PIR sensors depends on several other issues, including the distance of the persons body from the PIR sensor, direction and speed of movement, and presence of multiple people.Ying-Wen Bai, Chen-Chien Cheng and Zi - Li Xie[2] In this paper author design and implement an organized monitoring system by use of ultrasonic signal coding of ultrasonic sensors with multiple PIR to detect an outsider coming towards a home or a storehouse. The PIR sensors are placed on the ceiling.

Wang Huiyong, Wang Jingyang, Huan g Min [3] The architecture of the system includes Five main blocks are involved - the home server, the WSN system, smart devices, network of cameras, and mobile service robots. The home server is the center of information and the control center of the whole smart home system. It provides means to store information, monitor the devices, send particular tasks of the user and then prepare plans in a centralized way.

M. Kuzlu , M. Pipattanasomporn and S. Ra hman[4] – I it provides the Home owner the ability to automatically perform Smart load controls based on utility signals ,customers preference and load priority.It provides HEM hardware demonstration .Emphasis is placed on HEM system setup and electrical measurement of the loads The management of energy consumption is well provided in this paper.

## III.DIMMING

Dimming is an important feature of modern lighting that many consumers value. The ability to reduce light levels offers several benefits to the user. First and foremost, dimming can provide a specific level of desired illumination to the occupants of a space which increases the comfort level of the occupant. Dimming a lamp or fixture allows the user to vary and set the exact amount of light desired or needed for a specific application. Dimming can also be used when there is daylight supplementing the space or when a certain mood is desired for the room. Second, dimming a lamp provides reduces the power consumption of the lamp and provides energy savings. Via dimming, the customer reduces their electric bill while the utility sees a reduction in energy demand on the grid. Both of these impacts are important in areas with high energy costs. Lastly, having a dimmer in the circuit versus not having a dimmer in the circuit can often provide 5% energy savings even when the dimmer is set to full brightness. This is due to the voltage clipping which is described further in the following section. These are not the only benefits of dimming light, but are some of the primary reasons dimming exist.

## IV. SYSTEM ANALYSIS

System analysis is done on MATLAB tool with the help of ARM controller and optimizing algorithm. Figure shows block diagram of ARM controller and optimization algo¬rithm, for the appliances. Before actual implementation of the controller overall transfer function is to find out, which includes the transfer function of the appliance, feedback signal and objective function of the optimization algorithm. On the bases of the overall transfer func¬tion ARM tuning parameters are calculated and transient responses are observed.
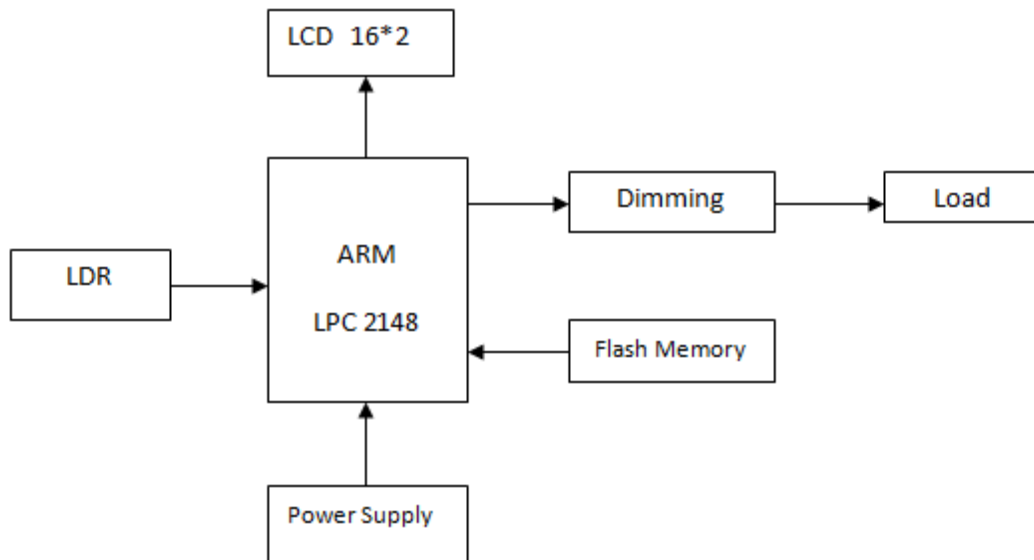
**Light Intensity Control System Analysis**
Transfer function for Bulb
Transfer function of bulb is observed as –

$$T(s) = \frac{e^{-Ls}}{1+sT} \quad \text{....... (1).......}$$

Where,
L – Inductance of filament.
R – Resistance of filament.
Overall transfer function of Light Intensity control system for PID controller is

$$\frac{(17970s + 7322)}{(s^2 + 23170s + 7322)} \quad \text{........ (2) ........}$$

Overall transfer function of Light Intensity control system for GA-PID is

$$\frac{(2.003e004\,s + 9023)}{(s^2 + 25230s + 9023)} \quad \text{........ (3)........}$$

Overall transfer function of Light Intensity control system for PSO-PID is

$$\frac{(3.011e004\,s + 1.501e004)}{(s^2 + 35311s + 1.501e004)} \quad \text{........ (4)......}$$

## V.CONCLUSION

Dimming always saves energy.

Even though there is not always a linear relationship between light output and energy consumed, and efficacy varies with light level, in modern systems, there is always a reduction in energy when lighting is dimmed. The perceived brightness does not decrease as quickly as the power decreases when dimming. Therefore, the benefit is greater that might be assumed.

## REFERENCES

1. Qela B, Mouftah HT. Observe, Learn, and Adapt (OLA) - An algorithm for energy management in smart homes using wireless sensors and artificial intelligence. IEEE Transactions on Smart Grid. 2012 Sep; 3(4):2262–72.
2. Bjorkboma M, Nethib S, Erikssona LM, Janttib R. Wireless control system design and co-simulation. Control Engineering Practice, Elsevier. 2011 Sep; 19(9):1075–86.
3. Keyson D, Mahmud AA, Hoogh MD, Luxen R. Designing a portable and low cost home energy management toolkit. The 3rd International Conference of Sustainable Energy Information Technology, Procedia Computer Science, Elsevier; 2013. p. 646–53.
4. Ibrahim D. Teaching digital control using a low-cost microcontroller- based temperature control kit. International Journal of Electrical Engineering Education, SAGE journals. 2011; 40(3):175–87.
5. Kim WH, Lee S, Hwang J. Real-time energy monitoring and controlling system based on ZigBee sensor networks. International Symposium on Intelligent Systems Techniques for Ad hoc and Wireless Sensor Networks, Procedia Computer Science, Elsevier; 2011. p. 794–7.
6. Si W, Ogai H, Hirai K, Takahashi H, Ogawa M. An improved PSO method for energy saving system of office lighting. IEEE Proceedings of SICE Annual Conference (SICE); 2011 Sep. p. 1533–6.
7. Ravi S, Sudha M, Balakrishnan PA. Design of intelligent self-tuning GA ANFIS temperature controller for plastic extrusion system. Modelling and Simulation in Engineering, Hindawi Publishing Corp. 2011; 2011.
8. Tong Q, Zou X, Zhang Q, Gao F, Tong H. The hardware/software partitioning in embedded system by improved particle swarm optimization algorithm. IEEE Symposium on embedded computing; 2011. p. 43–6.
9. Zheng G, Zhang Z. Intelligent wireless electric power management and control system based on ZigBee technology. IEEE International Conference on Transportation, Mechanical, and Electrical Engineering (TMEE), 2011. p. 1120–4.
10. Wong CC, Li SA, Wang HY. Optimal PID controller design for AVR system. Tamkang Journal of Science and Engineering. 2009; 12(3):259–70.
11. Han J. Remote-controllable and energy-saving room architecture based on ZigBee communication. IEEE Transactions on Consumer Electronics. 2009 Feb; 55(1):264–8.
12. Dae-Man H, Lim JH. Smart home energy management system using IEEE 802.15. 4 and ZigBee. IEEE Transactions on Consumer Electronics. 2010; 56(3):1403–10.
13. Jinsoo H, et al. Smart home energy management system including renewable energy based on ZigBee and PLC. IEEE Transactions on Consumer Electronics. 2014; 60(2):198–202.