A

Project Stage -I

Report on

Automatic Room Light Intensity Based Window Blind Control System

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2020-21

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In partial fulfilment of requirement for degree of Bachelor of Technology

In

Mechanical Engineering

Submitted By

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CERTIFICATE

This is to certify that the Project stage -I entitled **"Automatic Room Light Intensity Based Window Blind Control System"** has been carried out by team:

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Acknowledgement

We take this opportunity to express our heartfelt gratitude towards the Depart- ment of Mechanical engineering R. C. Patel Institute of Technology, Shirpur that gave us an opportunity for presentation of our project in their esteemed organization.

It is a privilege for us to have been associated with **Prof. S. P. Badgujar**, our guide during project work. We have been greatly benefited by his valuable suggestion and ideas. It is with great pleasure that we express our deep sense of gratitude to his for his valuable guidance, constant encouragement and patience throughout this work.

We express our gratitude to **Prof. P. L. Sarode** Head of Department, Mechanical Engineering for his constant encouragement, co-operation and support andalso thankful to all people who have contributed in their own way in making this project stage-1 work success.

We are thankful to **Prof. Dr. J. B. Patil**, Principal, R. C. Patel Institute of Technology, Shirpur for the support and encouragement. We take this opportunity to thank all the classmates for their company during the course work and for useful discussion we had with them.

Under these responsible and talented personalities, we were efficiently able to complete our project stage-1 work in time with success.

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Abstract

Electricity costs RS. 500-700 a month for an average middle-income household (800 to 1000 kWh) (kilo watts-hours). Many households could potentially save 50 percent to 70 percent of this if they used energy-efficient appliances, and even more if they used natural light for illumination. We plan to create an automatic blind control system that responds to the amount of sunlight outside in order to conserve energy in this project. If there is sunshine outdoors, the blinds are opened to take advantage of it and prevent the use of electric lighting. The amount of light that passes though the blinds is equal to its size. We intended to use a stepper motor to power the blinds, and the strength of sunlight is sensed using light based resistance interfaced to the microcontroller's on-chip ADC. It collects data from the sensor, specifies if the blinds should be opened, and activates the motor through the motor driver. PIC microcontrollers with high source and sink currents were selected because of the robust technological and paper support and integrated on-chip peripherals available. Firmware (software for embedded systems) is written in Micro C since it takes less time to build, is easier to debug, and is easier to understand than assembly language

Contents

List of Figures		**ii**
List of Tables		**iii**
Sr. No	**Description**	**Page No**
1	Introduction	4
	1.1 General	4
	1.2 Objectives	5
	1.3 Scope	5
2	Literature Survey	6
	2.1 General	6
	2.2 Related Articles	6
3	Problem identification and project objectives	8
	3.1 The Problem	8
	3.2 Objective of Study	8
4	Design Methodology /Analysis	9
	4.1 General	9
	4.2 Design Requirements	9
5	Project Management	14
	References	15

List of Figures

Sr. No	Description	Page No
1.1	World Consumption of Energy, 1990-2015	4
4.1	Block Diagram	9
4.2	Light Sensor	11
4.3	Stepper Motor	11
4.4	Bipolar Stepper Motor	12

List of Tables

Sr. No	Description	Page No
4.1	Bill of Materials	13
5.1	Bar Chart	14

Chapter 1
Introduction

1.1 General

Embedded is the combination of both hardware and software. Hardware in this field is electronics hardware whereas the software is the programming of the microcontroller. To fulfill the requirements about comfort and energy efficiency, building managers have implemented programs to reduce lighting energy requirements by installing more efficient light sources and luminaires. However, this is not sufficient. Lighting energy management has to provide the optimal lighting level for the tasks being performed using the most efficient light source suitable for the application, and providing light only when and where it is needed. This can be achieved by using lighting control strategies and lighting control system. The main purpose of these systems is to reduce energy consumption while providing a productive visual environment.
This includes:
1. Providing the right amount of light.
2.Providing that light when it's needed.
The world's energy usage has risen at an unprecedented pace over the last 15 years. According to a BP (British Petroleum) statistical analysis, global consumption has risen from around 8,500 to over 13,000 million tons of oil equivalent, as seen in Figure 1.1

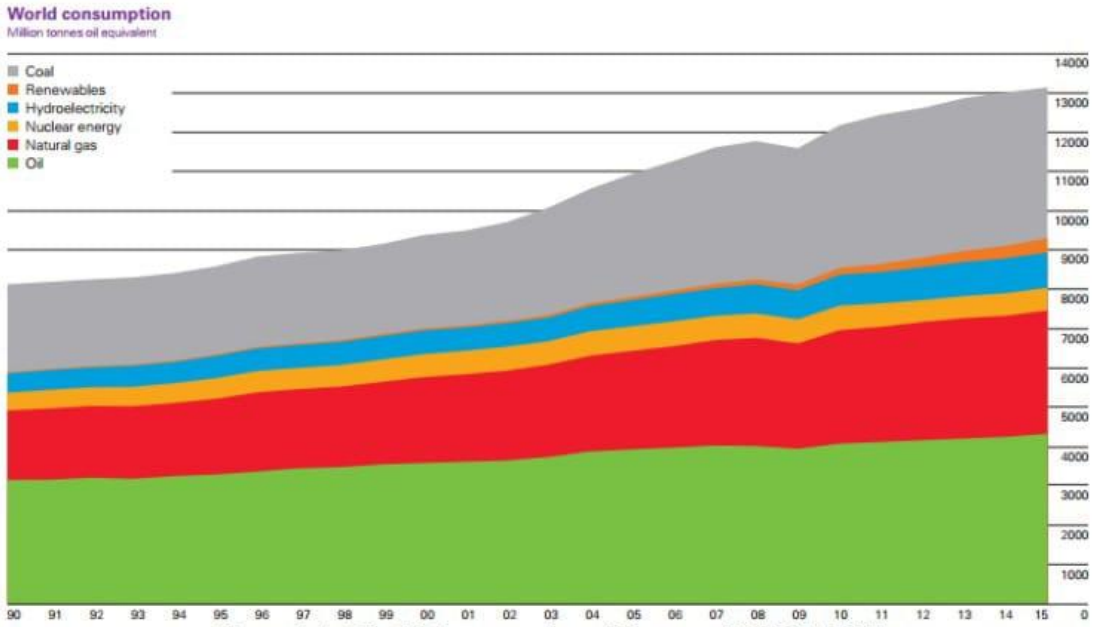

Figure 1-1. World Consumption of Energy, 1990-2015 [1]

The concern is that all of the energy sources illustrated in Figure 1.1 are non-renewable, which means they can deplete or cease to exist in our lifetimes. That include coal, oil, and natural gas, which are the three most commonly used energy sources on the earth [2]. If these resources will not be replenished in our lifetimes, our demand rate will outpace our supply rate, resulting in the exhaustion of these resources. This is why reducing energy usage is becoming more crucial in order to ensure that we can have enough energy to sustain life in the future.

Many new and creative innovations have gained market interest over the last 15 years as a result of this issue. Advanced manufacturing, LED illumination, hybrid motors, and solar technology are just a handful of the developments. Global production of solar technology has risen by 30% in the last 30 years, with prices dropping by about 10% each year [3]. This technology's expanded output has been enabled by advancements in energy management and processing, which has greatly decreased the usage of nonrenewable capital. LED illumination, on the other hand, is one way to minimize total energy consumption since it uses 80% less energy than halogen bulbs and 25% less energy than CFLs [3]. Home renovations, whether by LED lighting or creative building architecture, are a significant way that society is attempting to reduce energy usage.

New energy efficiency developments such as improved house frame designs, cool roofs, and solar panels have become the subject of home technologies. For a wood-framed building, advanced housing frames minimize the volume of timber used and waste. Reflective fabrics are used on cool roofs to reflect lighter and retain less heat from the sun. Solar panels on the roof increase the amount of sunlight that enters them each day, supplying electricity for the home [4]. These innovations are important because they favor home buyers by lowering electricity demand and, as a result, energy prices. The smart blinds device is one such technology that achieves this aim.

1.2 Objectives

Objective of this project is to make a prototype smart blind system which automatically control daylight which enters the room while maintain room privacy of the user. Project includes design and making a prototype model, compile a program using Arduino IDE, makes necessary circuitry and DC motor controlling.

1.3 Scope

Smart blind system prototype consists with several flaps and uses a standard window. Reason to use several flaps is to reduce the motor torque need to control the flaps. This project can be developed in to a solar powered smart blind system by installing simple circuitry to recharge the batteries in day time. Smart blind system can be developed in to a more advanced device by making switch inputs to automate light bulbs, HVAC systems and advanced security systems.

Chapter 2
Literature Survey

2.1 General

The Egyptians chose to string reeds together to form blinds, while the Chinese strung together bamboo in order to keep people safe from the sun. The next big blinds came when the Persians introduced blinds to Venice, which is where the term “Venetian” blinds started. An Englishman named Edward Bevan was award the first patent for Venetian blinds in 1769, using wooden slats. By placing this slat in a frame and manipulating the slats, he discovered you could allow a certain amount of light into a room.

2.2 Related Articles

[1]. John Hampson (2012) approach stated the history of Venetian window blinds is mostly conjectural, they are thought to have originated in Persia, not Venice. Venetian traders discovered the window coverings through their trade interactions in the East and brought them back to Venice and Paris. To this day, the French call Venetian blinds “Les Persienes,” and remain loyal to their true place of origin. After their introduction to Europe in 1760, they became popular window coverings across the continent.

[2]. Hunter Douglas (2014) was the first company to develop a light, aluminum Venetian blind in 1946. Other notable improvements include the use of motors to automatically control the blinds rolling up and/or changing the angle. more popular motorized blinds include a screen that is being controlled to let in sunlight, although motorized venetian blinds are also available.

[3]. Benson (2012) approach state that the, Arduino is a microcontroller which has become so popular in the recent times in robotics projects. There are various types of Arduino boards which differ from one to one in size, features and also processing power. The only functionality this microcontroller provides is what is programmed on to it by the user. It is capable of reading data from sensors, compute data, transfer data to a PC or output them to LEDs or LCD screens attached to the board. These microcontroller users open-source software based on C language. Arduino is based on an AVR microcontroller which has a much simpler development tool. These microcontrollers are popular mainly because of the simple development tool, open source and also, it’s very much cheap compared to other microcontrollers in the market.

[4]. Tzempelikos and Athienitis (2007) found that a reduction of 31% in total secondary energy

can be achieved by applying active (closing the shades when beam solar radiation on window exceeds 120 W/m2) lighting and shading control.

[5]. Dubois (2001) also reported a reduction of between 23% and 89% in cooling energy by using shades. Cho et al., (1995) studied the effect of slat angle and absorptance on the showed a reduction of 5% and 30% in heating and cooling loads respectively. From these figures, it is evident that a rational use of shading devices can result in significant energy saving. On the other hand, glazed surfaces without shading devices can decrease heating demand by employing passive solar design and making use of the renewable energy source, the Sun. This design strategy can lead to overheating in occupied spaces and a shading device can be used to reduce solar gains through windows.

[6]. Heerwagen and Heerwagen (1986) conducted survey and found that half of the subjects believed that natural lighting is better for psychological comfort, general health and visual health. The importance of comfort is well acknowledged nowadays.

[7]. Cuttle (1983) survey also investigate the perceived attribute of windows found that 86% of the participants preferred daylighting over artificial lighting. Results from interviews conducted by Wells (1965) showed that 69% of the participants believe that it is better to work under natural lighting than electric lighting.

Chapter 3
Problem identification and project objectives

3.1 The Problem

As sustainability has come to the forefront of modern technology, people are continually looking for ways to be more sustainable in their everyday lives. The field of smart-home technology fits into the homeowner's attempt to become more sustainable. Ranging from solar panels to thermostats, people are continually finding new ways to advance this technology. This is where the idea for automated blinds comes into play. As another way for homeowners to be more sustainable and save money, automated blinds will allow homeowners to save energy, and money, by not having to manually control their lights and blinds [8]. Homeowners waste energy by leaving lights on and blinds closed throughout the day, when there is plenty of natural light for them to take advantage and to keep the necessary amount of light in the room. The proposed smart blinds will work along with a light switch set the desired amount of light in the room, while automatically adjusting the blinds to sustain the amount of light; therefore, saving the homeowner money and energy.

3.2 Objective of Study

The design we are striving for will incorporate ideas from these previous projects and improve upon them. By incorporating a second sensor inside the room, our blinds will be able to compare the light inside and outside of the room, compare them, adjust the indoor lighting, and adjust the blinds to have a comfortable amount of light in the room. The next design improvement that our system will have over these competitor designs is that the entire system (blinds, sensor, microcontroller, etc.) will all be included in the system, rather than requiring the user to piece them together on their own. Lastly, with a basic knowledge of microcontroller coding, the user will have the ability to adjust the amount of light that they view as a "comfortable" level. The overall objective of our project is therefore to design a system that will save energy and money by incorporating indoor lighting and automated blinds to give the howeowner a comfortable amount of light in their homes.

Chapter 4
Design Methodology

4.1 General

The aim of the project is to design such as sliding windows are used in house. There are two LDRs used to automate the house. First LDR used to control the window as open/close when sun lights fall on to the LDR. Second LDR used to control the intensity of light in the house according to the sun light intensity using PWM technique system. The basic concept of our automated system is that the position of the blinds is dependent on the intensity of light. A microcontroller receives the level of intensity from a photo resistor and sends an appropriate signal to the motor driver, which then steers the stepper motor to one of two desired states. The first state is referred to as our ground state. The ground state is achieved when ambient light is present at the face of the window. At this particular time, the blinds are turned to a fully open position.

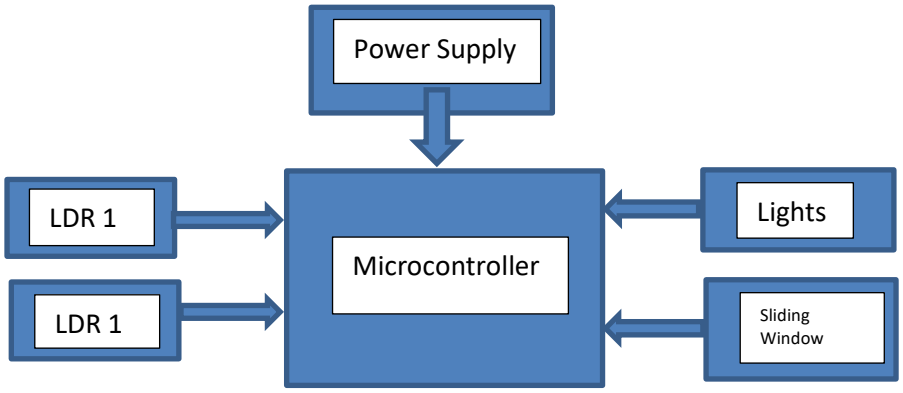

Figure 4.1- Block Diagram

4.2 Design Requirements

Power Supply

In alternating current, the electron flow is alternate, i.e., the electron flow increases to maximum in one direction, decreases back to zero. It then increases in the other direction and then decreases to zero again. Direct current flows in one direction only. Rectifier converts alternating current to flow in one direction only. When the anode of the diode is positive with respect to its cathode, it is forward biased, allowing current to flow. But when its anode is negative with respect to the cathode, it is reverse biased and does not allow current to flow. This unidirectional property of the diode is useful for rectification. A single diode arranged back-to-back might allow the electrons to flow during positive half cycles only and suppress the negative half cycles. Double diodes arranged back-to-back might act as full wave rectifiers as they may allow the electron flow during both positive and negative half cycles. Four diodes can

be arranged to make a full wave bridge rectifier. Different types of filter circuits are used to smooth out the pulsations in amplitude of the output voltage from a rectifier. The property of capacitor to oppose any change in the voltage applied across them by storing energy in the electric field of the capacitor and of inductors to oppose any change in the current flowing through them by storing energy in the magnetic field of coil may be utilized. To remove pulsation of the direct current obtained from the rectifier, different types of combination of capacitor, inductors and resistors may be also be used to increase to action of filtering.

Microcontroller

The PIC16F877A is a microcontroller with 8K x 14 words Flash and 368 x 8 bytes bytes of data RAM. The Flash program memory supports both parallel programming and in serial in-System Programming (ISP). Parallel programming mode offers gang-programming at high speed, reducing programming costs and time to market. ISP allows a device to be reprogrammed in the end product under software control. The capability to field/update the application firmware makes a wide range of applications possible. The PIC16F877A is also In-Application Programmable (IAP), allowing the Flash program memory to be reconfigured even while the application is running.

LDR

LDR is a resistor whose resistance decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. It can also be referred to as a photoconductor or CdS device, from "cadmium sulfide," which is the material from which the device is made and that actually exhibits the variation in resistance with light level. Note that although CdS is a semiconductor, it is not doped silicon. A photo resistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.

Sliding Window

We have used a DVD driver as sliding window. This sliding window Is associated with a dc motor and that dc motor is controlled by a wheel motor control IC (L293d). This sliding window is work according to the outside sunlight intensity. When there is sunlight outside a signal is sent to the microcontroller which controls the window. At the day time blinds remain open and they become close during night time. A LDR is made to sense the outside sunlight. After once when window will get open or close the feedback is sent back to the microcontroller. The microcontroller then sends a signal to close the dc motor. Since if we do not provide a feedback then there is a power loss in circuit and it may damage the motor and wheel motor IC also.

Lights Sensor

The light sensor is a passive device that convert this “light energy” whether visible or in the infra-red parts of the spectrum into an electrical signal output. Light sensors are more commonly known as “Photoelectric Devices” or “Photo Sensors” because the convert light energy

(photons) into electricity (electrons). Light sensors measure illuminance, which can be used to measure more than the brightness of a light source. Because the illuminance decreases as the sensor moves away from a steady light, the light sensor can be used to gauge relative distance from the source.

Figure 4.2- Light Sensor

Stepper motor

Stepper motor drivers are specifically designed to drive stepper motors, which are capable of continuous rotation with precise position control, even without a feedback system. Our stepper motor drivers offer adjustable current control and multiple step resolutions, and they feature built-in translators that allow a stepper motor to be controlled with simple step and direction inputs. These modules are generally basic carrier boards for a variety of stepper motor driver ICs that offer low-level interfaces like inputs for directly initiating each step. An external microcontroller is typically required for generating these low-level signals. A stepper drive is the driver circuit that controls how the stepper motor operates. Stepper drives work by sending current through various phases in pulses to the stepper motor. Two-phase-on driving has its name because two phases are on at a time.

Figure 4.3- Stepper Motor

Bipolar Stepper Motor

A bipolar stepper motor has one winding per stator phase. A two-phase bipolar stepper motor will have 4 leads. In a bipolar stepper, we don't have a common lead like in a unipolar stepper motor. A bipolar stepper motor has easy wiring arrangement but its operation is little complex. In order to drive a bipolar stepper, we need a driver IC with an internal H bridge circuit. This is because, to reverse the polarity of stator poles, the current needs to be reversed. This can only be done through a H bridge.

Figure 4.4- Bipolar Stepper Motor

Table 4.1- Bill of Materials

Count	Description	Part Number	Manufacturer	Per Unit Cost $
1	STEPPER DRIVER 0.75A 30V LOAD	ROB-12779	SparkFun Electronics	14.95
1	STEPPER MOTOR HYBRID BIPOLAR 24V	316020003	Seeed Technology Co., Ltd	14.79
1	PC BOARD 2-SIDE PPH 2.0X3.0	8029	Vector Electronics	6.72
1	ARDUINO UNO BOARD REV3	A000066	Arduino	23.38
1	9V BATTERY	43946	Rite Aid	5.92
1	SMAKN DC-DC CONVERTER BUCK	RC8-60S0505	SMAKN	15.79
2	CORNER BRACE	30699150694	Home Depot	2.98
2	SWITCH TACT 6mm MOM 150 GF	B3F-1022	Omron Electronics Inc	0.36
1	MINIBLIND	4719867344788	Home Depot	3.98
2	ADAFRUIT LIGHT SENSORS	TSL2561	Adafruit	5.95
1	STEPPER MOTOR BRACKET	A00611A01	LANMU	7.99
4	50mm M3 SCREWS	a15070200ux0102	UXCell	0.67
2	5mm BORE PULLEYS	O3D037	Orish	10.99
			Total:	126.44

Chapter 5
Project Management

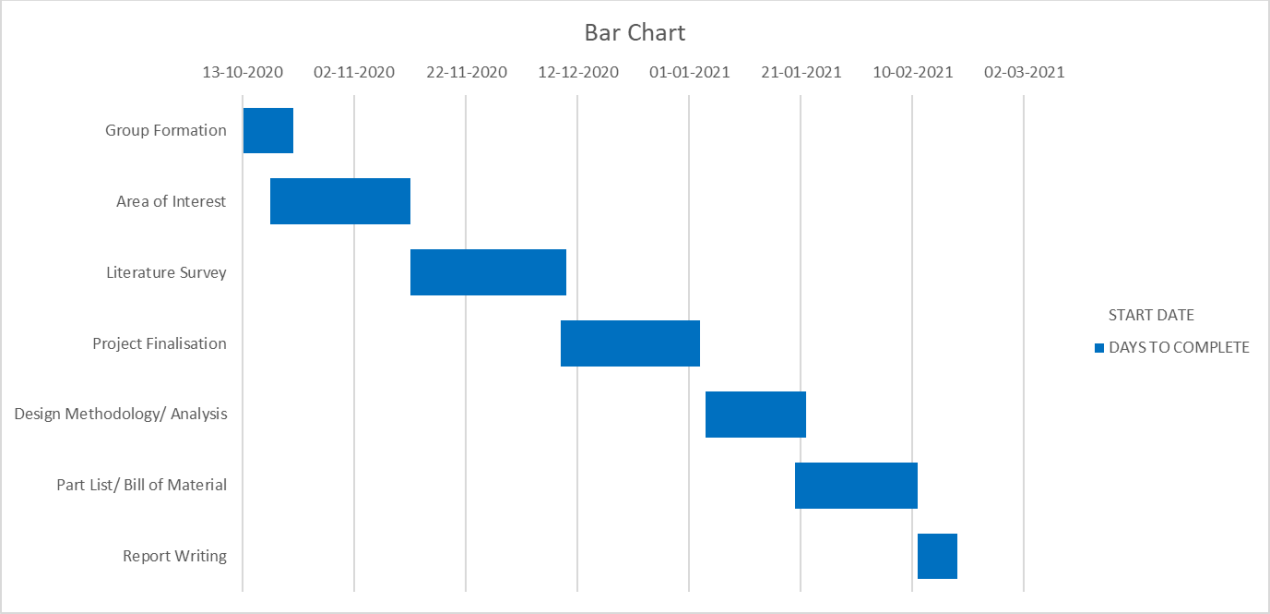

Table 5.1- BAR Chart

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