Wireless Controlled Kinaesthetic Surgical Light System

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ABSTRACT: A combination of several surgical lights is often referred to as a surgical light system. The surgical light system are used in operation theatres, orthopaedic rooms etc. A surgical light system also referred to as an operating light or surgical light head is a medical device intended to assist a surgeon during a surgical procedure by illuminating a local area of the patient undergoing surgery.

The present days surgical light systems are operated manually either by the surgeon or an assistant intended for the purpose. This is the drawback of this system.

We, through this project propose to overcome the above mentioned drawback by introducing a sensor guided, microcontroller operated, motorised arm, to hold and move the light source as directed by the surgeon.

KEY WORDS: surgical light, microcontroller(AT89C52), sensor module, motor drive, dimmer circuit.

I. INTRODUCTION

Proper light is a critical element in the success and outcome of a surgical procedure. Surgical light is the most important surgical equipment in the operating room. Before the invention of electric lights, sunlight was the primary light source unless candlelight had to be used in emergency situations. Surgical light systems are used in medical offices, ambulatory surgery centres, hospitals, research facilities, educational institutions, and veterinary clinics throughout the world. In present days surgical lights consist of a handle in the centre of the light for moving purpose. This system is operated manually by the surgeon or assistant. the idea of our project is to introduce a wireless control on the movement of the light system which reduce the manual operation. As the design technology advances and the use of the surgical systems increases throughout the world. The surgical system are modelled in different types depending on the application. Depending on the mounting configuration of the surgical lights these are categorised as:

- Ceiling mounted
- On floor stand
- Wall mounted

They also be categorised by lamp type that is used in the surgical system to illuminate the light.

- Light emitting diodes(LED)
- Halogen lights
- Xenon lights
- Metal halide lights

II. RELATED WORK

Now-a-days the present existing surgical light systems are operated manually. The surgeon or an assistant intended for this purposes to move the light to the required area. And due to the continuous focus of the light Patients were burned by lights in which heat-protection filters were removed. Burns were heavy when multiple surgical lights operated at or near maximum intensity were focused on the same field. When the light systems are moved by hands the fingerprints on a quartz-halogen lamp can cause the bulb to fail prematurely, become discoloured, or explode.

III. PROPOSED SYSTEM

To reduce the manual operation of the light system, we propose these wireless controllable surgical light system. And it also reduce the failure of the bulb due to the fingerprints while moving the light system. It moves the surgical light by using a sensor and the motor .

A.BLOCK DIAGRAM:
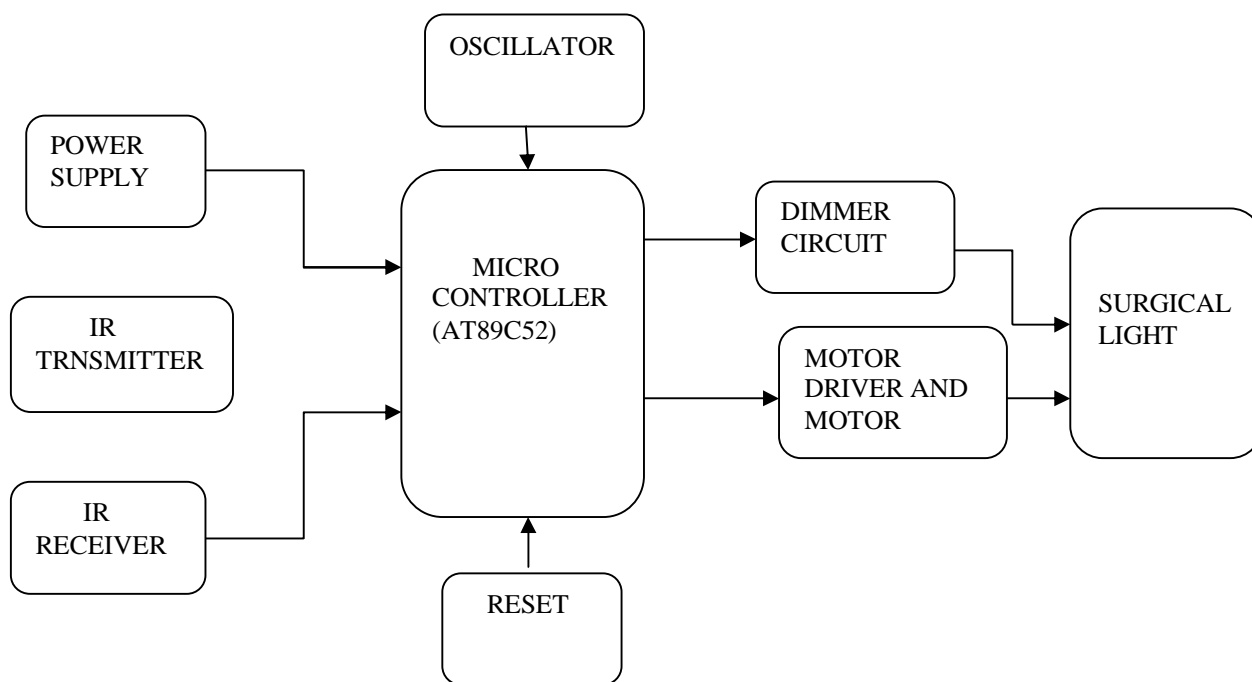
fig(1)

To move the surgical light to the required area we use the IR(Infrared red) sensor to guide the light system. The IR sensor is one of the sensor which is used for the short range wireless connection.

The power supply gives the 5V regulated power to the microcontroller. The IR transmitter is used for the wireless communication it continuously transmit the invisible IR rays. The IR receiver detect the transmitted IR rays and these signals are given to the microcontroller in which the commands are written the microcontroller process the received IR rays and execute the required command. depending on the executed command the motor operation is performed. The DC motor runs continuously when it receives the command from the microcontroller then the motor stops running. The motor and the IR receiver and the dimmer circuit are connected to the microcontroller. when the motor stops running the light is focused on the required area the dimmer circuit is used to vary the intensity of the light.

The motor driver runs on 12V power supply but the microcontroller runs on 5V supply to improve the voltage level from 5V to 12V driver circuit is used to run the motor.

B. HARDWARE COMPONENTS:

The hardware components that are used is given below

- Microcontroller[AT89C52]
- IR module[FC-51]
- motor driver[L293D]
- dimmer circuit
- Power supply

i. AT89C52:

The AT89C52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of Flash programmable and erasable read only memory (EPROM). The device is manufactured by Atmel company and it belongs to the 80C51 family it follows the 8051 instruction set. It has non-volatile memory that is it not depend on the power . It is a40 pin IC with dual in line package(DIP). The microcontroller has 4 ports each port having 8 pins it operates with a clock frequency of 11.0526MHZ a inbuilt crystal oscillator is used to generate the clock pulses. It has 8 data lines and 16 address lines the data and address lines are multiplexed with one another. It operates on the 5v powersupply.AT8C52 is a cost effective microcontroller which is used in many embedded control applications.

fig(2)

ii. FC-51:

The FC-51 is a IR module which consist of a IR transmitter and receiver. It consist of 3 pins GND,VCC, and OUT. The IR LED is a special type LED that emit the infrared rays of the electromagnetic spectrum. The wavelength of infrared rays Is greater than that of visible light the wavelength range is 740-760nm. The IR transmitter continuously transmit the IR rays and the IR receiver detect the reflected IR rays. the IR module is shown in fig(3) .It has a comparator which maintains logic high state when light is OFF state and it maintains logic low level when light is in ON state. IR receiver consist of photo detector, gain controller, band pass filter the demodulated signal can be directly demodulated by the microcontroller. It has a pot by varying the pot the range of the IR rays can be adjusted.

fig(3)

iii. L293D motor driver:

The L293D is a dual H-Bridge motor driver. The one IC can interface two dc motors which can be controlled in both clockwise and anti-clockwise direction. It is a 16 pin IC shown in fig(4). It consist of 4 switches which are connected in H form. If the top right, bottom left switches are close then current floes in forward direction and the motor runs in clockwise direction. If the top left bottom right switches are clock then the current flows in backward direction then the motor runs in anti-clockwise direction.
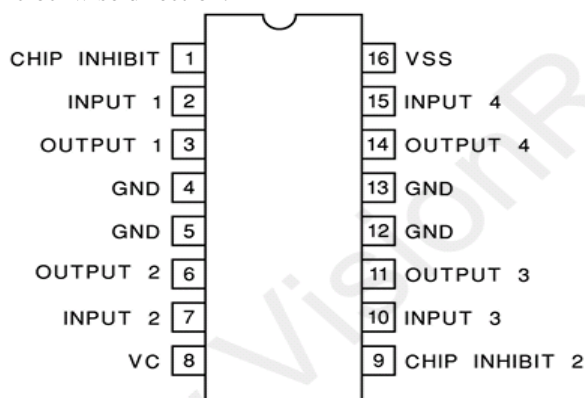
fig(4)

iV .DIMMER CIRCUIT

Due to the continuous focus of the light on to the body burns are happens to, reduce these burns of the patients the dimmer circuit is used. Which is used to vary the intensity of the light by varying the voltage that is applied to the lights. The circuit has a variable resistor which can control the flow of the current. The dimmer circuit is shown in fig(5) that has a pot.
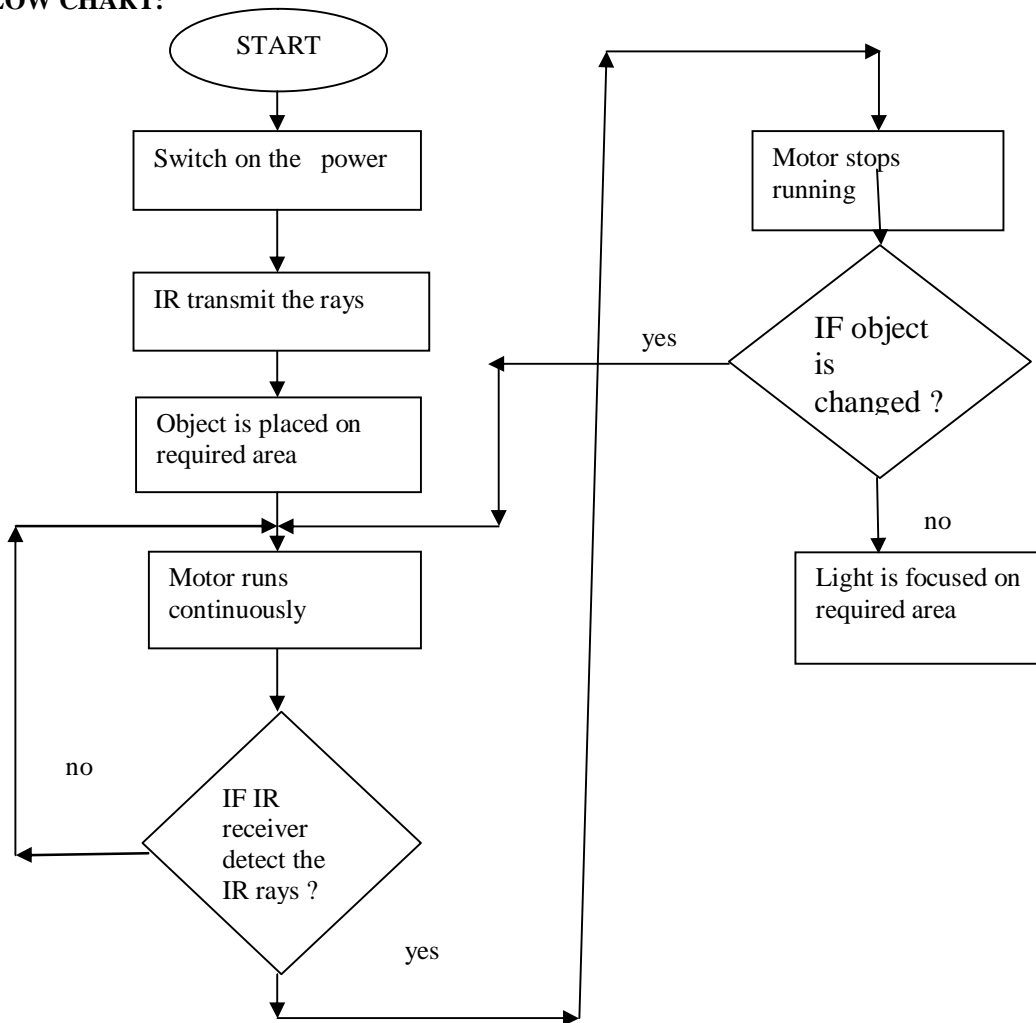

fig(5)

C. FLOW CHART:

fig(6)

When the power of the system is O N then the motor runs continuously which moves the light system. For wireless controlling of the system a wireless transceiver that is infrared(IR) sensor is used. The IR transmitter continuously transmit the IR rays. A object is placed in the required area in which the light is to be focused the object which is used is must be able to reflect the IR rays. When the reflected IR rays detected by the IR receiver it stops the motor running and the light is focused on the required area. When the object is changed from one place to other place then the IR receiver is unable to detect the IR signals then the motor starts running until the IR receiver detect the IR rays. The dimmer circuit is used to vary the intensity of the light that is focused on the required area it reduces the burns to the patients due to continuous focus of the light.

IV. HARDWARE IMPLEMENTATION

Fig(7) shows the hardware implementation of the system Here, the LED lights are used to illuminate the light. A motor is connected to the light system to move the light. The motor is connected to the microcontroller in which the

commands are stored depending on the command the motor moves the light. The IR transceiver continuously transmit the IR rays an object which has a ability to reflect the IR rays is placed on the required area. The IR transceiver is placed on the movable arm of the light. When the IR rays bounce the object it reflect the IR rays and the reflected IR rays are detected by the IR receiver. Hence, the IR transceiver is connected to the microcontroller whenever the IR receiver detect the IR rays it sends the signal to the microcontroller then it process the signal and execute the command to stop the motor. When the object is changed from one place to other then the IR receiver does not able to detect the IR rays then the microcontroller sends a command to run the motor until the IR rays are detected.
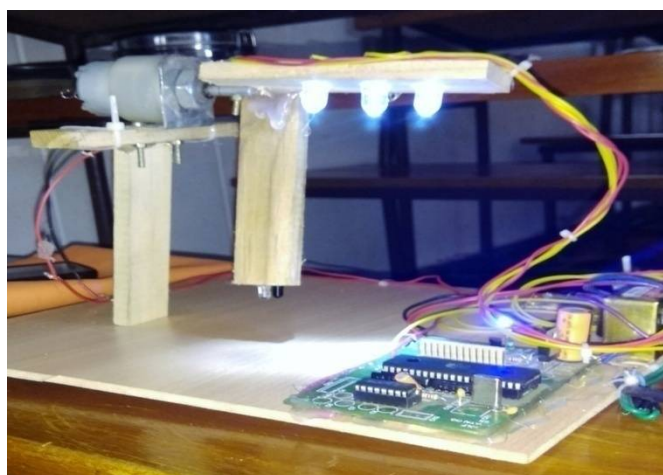
fig(7) overall system

V. RESULT

1.light system which detect the object: If the object is placed on the required area then the IR rays which are reflected by the object is detected by photodiode then motor stops running. Light is focused on the required area.

fig(8)

2. dimmer circuit which vary the light intensity:

When the potentiometer is in minimum position then the light intensity is high as in fig(9).

fig(9):High intensity of light when pot is in minimum position

When the potentiometer is in maximum position then the light intensity is low as shown in fig(10)

fig(10):Low intensity light when pot is in maximum position

VI. CONCLUSION

The system has been designed and tested to control the movement of the surgical light system by using a wireless mechanism. This system can reduce the manual operation of the light

VII. FUTURE SCOPE

At present all the electronic systems can be controlled with different technologies hence we are initialised this wireless controllable surgical light system to control the movement of the light as directed by the surgeon using the wireless technology.

further, in future this system can be implemented to move the light system automatically with the voice control of the surgeon.

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