

Robotic Arm Assisted Laser Surgery with LiFi Based Patient Monitoring System

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Abstract: *With the advances in electronics and control software, robotic arms are now capable of quick and accurate movement under a wide range of conditions. Robotic surgery has become the most important field of general surgery. This rapid progress is quantitative and qualitative. The common procedures performed in Robotic Field and the future advancements are being discussed in this paper. Along with the existing system of Robotic surgery the advanced instruments and the future possibilities are being discussed. This project will help to solve the existing problems in robotic surgery even in other additional fields. Now a days the limitations of WiFi has reduced the usage in medical field especially. Therefore a LiFi based system will enable to overcome the limitations of Wi-Fi. A continuous monitoring of the vital parameters of the body like temperature, pulse rate and glucose level is also required. Regular interval of time measuring the intensive parameter of the patient's health with a low cost micro controller and intelligent LiFi based advanced patient monitoring system is developed and if any abnormal condition occurs, it directly sends a message to the doctor's base station machine via Li-Fi that particular word no's particular parameter is out of the range. Doctor can do the fast assessment of the patient's health without wasting the time with the help of an alert message.*

Keywords: *Robotic Surgery, Wireless LiFi, Intensive Parameters, Advanced Patient Monitor*

I. INTRODUCTION

Robots are replacing many procedures of the human beings now days. Hospitals are improvising the surgery techniques and procedures using robots like robotic assisted laser surgeries. Robots can be autonomous, semi-autonomous or remotely controlled. Artificial intelligence has been developing and robots have taken over a wide variety of tasks from aerospace to agricultural fields. Processing of images provide the necessary signal of intelligence to guide the mechanical parts to perform task. An extraordinary capability of sense of touch is experienced by humans. In this project the robotic arm will be able to perform mechanical operations wirelessly without much effort. LiFi is transmission of data through a LED light bulb in which illumination takes place by the fiber out of fiber optics that varies in intensity. Simple techniques like a switch, when the LED is ON, digital 1 will be transmitted and when the LED is OFF, it transmits digital 0. LiFi can be switched on and off very quickly, and the data is transmitted. When the LED switches on and off, the rate can be varied and the data will be transmitted and encoded. The rate at which the LED blinks cannot be viewed by human eye since it varies rapidly.

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Constant monitoring of the patient's body parameters such as body temperature, Pulse rate and sugar level etc is becoming difficult. Sometimes constant monitoring cannot be done by the nurses. Sometime, the patient's health changes to serious from normal condition. Various sensors used in this project will be able to monitor the parameters continuously with the help of Micro controller and display it on a LCD. Telemedicine techniques are implemented here. The data of the patient is transmitted to the doctor in intervals of time for the monitoring of the patient instantly. This data is provided to doctor via Wireless LI-FI modem. This project will continuously monitor the health which is a drawback in normal conventional system. Micro controller is used in this system AT89C51 which is very cheap in cost so system cost is automatically reduced. For transmission of the message Wireless LI-FI Technique is used. This project helps the patient to get immediate concern from the doctor. Even though the doctors are away

They can monitor the surgery and find the abnormalities. In places like environmental disasters where a lot of individuals will be injured, these robots can be used to treat them in more numbers and the doctors can wirelessly monitor in very difficult conditions were they cannot be physically available.

II. ANALYSIS AND METHODOLOGY ROBOTIC ARM:

The Robotic ARM is controlled by a wireless RF technology. Transmitter unit comprises of RF transmitter and switches. RF transmitter receives serial data and transmits it wirelessly through Rf antenna. The transmitted data is received by RF receiver and control the robotic arm. RF receiver receives and demodulates the transmitted signal. After demodulation received signal will be send to micro controller via buffer, driver and relay unit. A buffer is implemented as a temporary storage device, the driver will drive the rely to switch on and OFF accordingly.

Micro-controller analyses the signal and controls the robotic ARM movement with the help of a driver.

Li-Fi:

This project is designed to monitor the patient health care and if any emergency is there it will send information to the respective receiver with the help of Li-Fi Technology. Li-Fi is a new and wireless technology to transfer the information wirelessly. Here the patient Saline bottle will be monitored continuously, if that bottle becomes empty then the will detect that and it will activates the Encoder with the help of Multivibrator and Interfacing stage. A LiFi receiver will be implemented to receive the data that is transmitted in the physicians end.

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The another parameter is patient stress, here stress probe will be there monitor the patient stress continuously, if that crosses the minimum level then the sensors will detect that and it will activates the Encoder with the help of Multivibrator and Interfacing stage. Later the information will be transmitted to the LiFi receiver through Li-Fi transmitter.

The LiFi receiver will receive the data that is transmitted and the DTMF decode at the receivers end will decode the data and deliver it to the patients and the signal will be processed with the help of micro controller. After receiving, the micro-controller will displays the measured parameters like Saline Bottle Empty, Stress is high.

III. BLOCK DIAGRAM

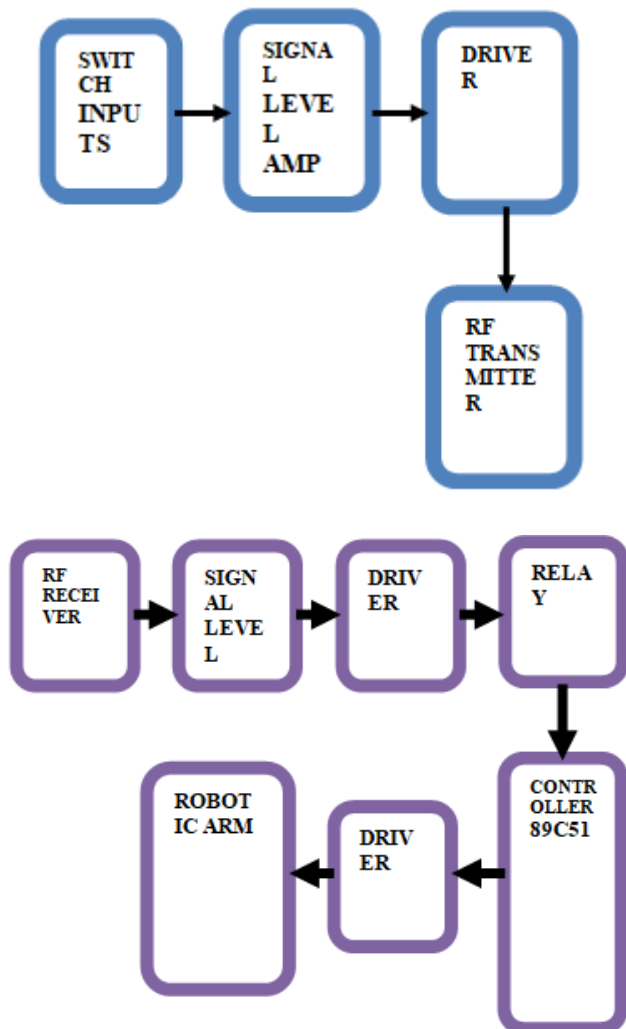
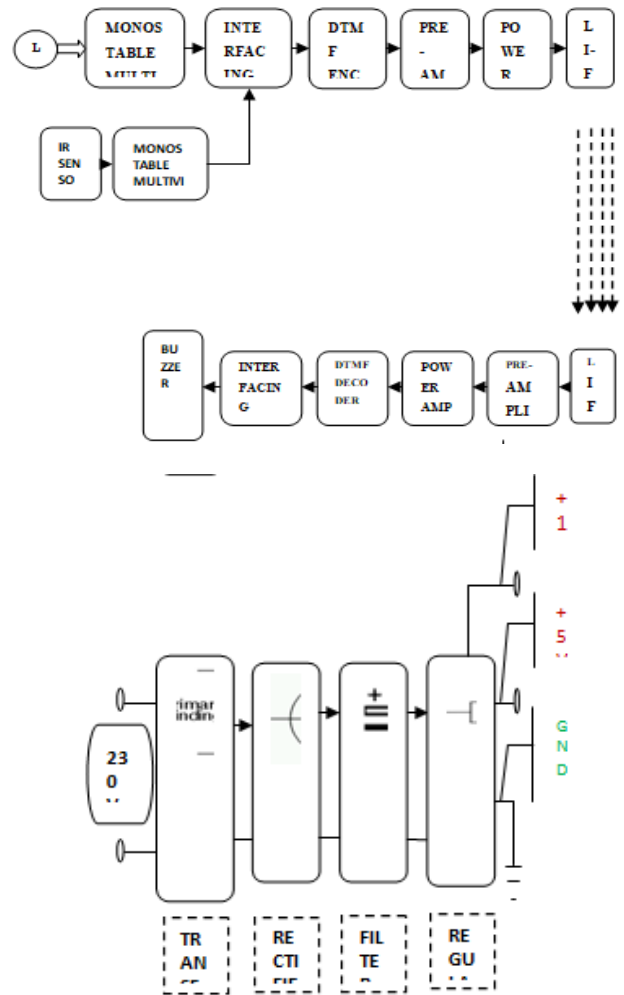


Fig: Block diagram of Robotic Arm Module



HARDWARE REQUIREMENTS:

Microcontroller
89C51, LCD, Relay
Driver, Relays,
Resistors,
Capacitors, LEDs,
Crystal, Diodes,
Transformer,
Voltage

Fig: Block Diagram of LiFi module

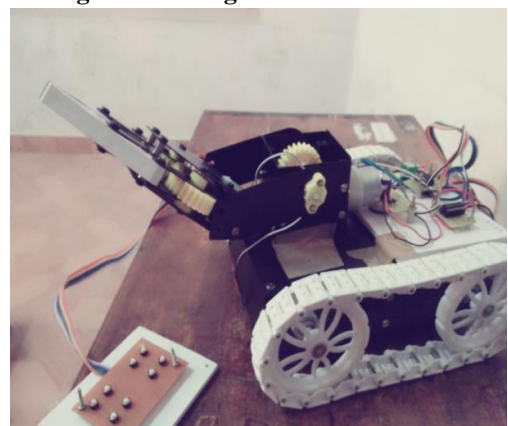
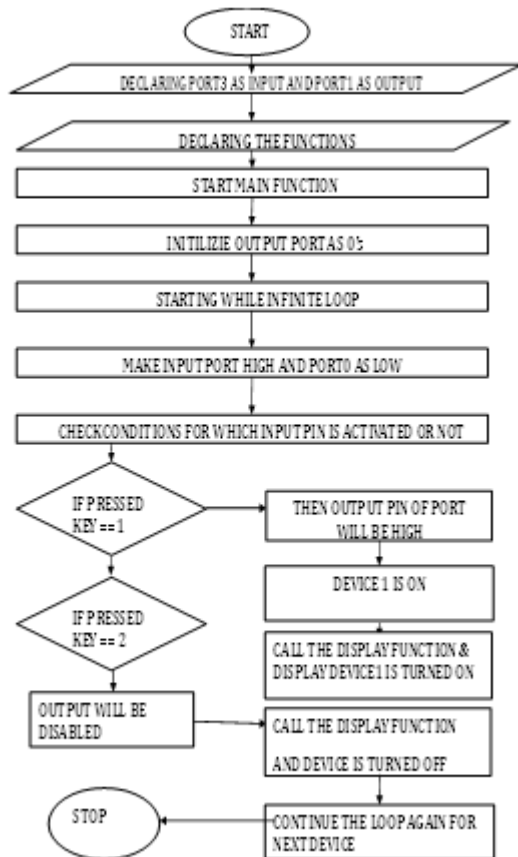


Fig: Up movement

FLOWCHART



IV. ADVANTAGES

ROBOTIC ARM:

- Minimally invasive surgery, extremely precise.
- Eliminate tremors and help in movement scaling.
- Ergonomically superior.
- Causes less fatigue for surgeons in prolonged surgeries.
- Laser introduces “bloodless surgery”.
- The surgical site is free of germs and reduces risk of infection.
- Reduces bleeding, swelling, pain and length of recovery period.

LiFi :

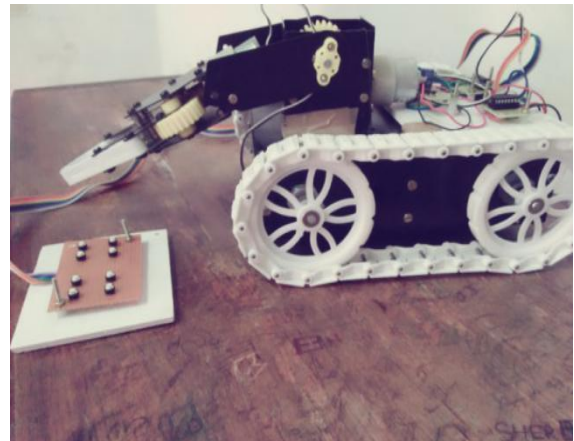
- Harmless for human body.
- Patient under isolation wards can be monitored without human interface.
- Increased security.
- There is no influence to other equipment’s radio waves.
- Less energy consumption.

V. APPLICATIONS

- A view of the field for surgery can be viewed in a 3-dimensional structure with the help of an endoscopic camera.
- Underwater communications, defense and security.
- Devices can monitor the condition of a patient in pre-designed intervals.

VI. LIMITATIONS

- RF Transmission and reception allows only certain movements to be operated
- IR sensor detects all the objects
- Skilled operator is required
- Friction at joints



(a)



(b)

Fig (a) Down Movement (b) Motion detection and Saline bottle empty detection

VII. RESULTS AND DISCUSSIONS

Robotic arm can help individuals distantly and will can more of precision during surgery. Remote locations can be accessed and help patients to treat immediately. Our project can undergo a minimally invasive surgery with less blood loss. A 3D imaging can be developed by placing a camera on the arm. The recovery of the patient is much faster in laser surgery when compared to normal manual surgeries .The accuracy of the robotic arm is high in medical operation. Speed of transmission is high in LiFi technology. LiFi is a non-radiation technique used for transmission.

VIII. CONCLUSION

The robotic arm has many moves with which the physician can easily access the surgical field and can be adjusted accordingly. A joystick will enable to move the robot in different directions and help the surgeon in movement and repeatability is enabled. The boredom and fatigue of the surgeon is avoided. Transmission of the measured parameters is done through visible light and the data will be secured.

Thus LiFi technology has made more easy to use with the wavelength range of 350-400 nm. A buzzer in this system will alert the surgeon as soon as something goes wrong.

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AUTHOR PROFILE



Lakshmi Shree B, have completed my masters in engineering in biomedical field. I have published 1 journal paper in Scopus indexed journal . And 2 research paper proposals are submitted . I am a member of IAENG and a fresher who is looking forward to research and learn more about the Biomedical technology.



Sandhiya R, Completed under graduate in panimalar institute of technology in the of electronics and communication engineering chennai .Her post graduate in colloge of engineering guindy in the field of medical electronics. My reasearch work in instrumentation and image processing .Now I am currently working as Assistant professor in Aarupadei veedu institute of technology.chennai.



Santhoshini Arulvallal, Mtech Biomedical engineering, Assistant professor, has done publication on topic "sleep apnea detection using smart watch and data analysis using neural network" in a scopus indexed journal, progressing research work in hypertension detection using pulse rate and submitted 3 Research proposals, Once awarded with best paper for the paper "Enhanced security using multimodal meta data Biometric systems".