

Object Gripping With Automated Robotic Arm Movement

Susmita Das¹, Manish Guha², Supravat Roy², Sayantan Mitra², Avipsa Basak²,
Nistha Gupta², Anismita Paul², Alivia Bose²

¹Assistant Professor, Electronics & Instrumentation Engg., Narula Institute of Technology, India

²B.Tech Student, Electronics & Instrumentation Engg., Narula Institute of Technology, India

Corresponding Author: Susmita Das

Abstract : In the upcoming era of advanced technology, for the ease of the human being living, industrial automation with lesser human effort and all other possible application areas are enriched with the ever growing features of technical advancement in the field of Robotic mechanism. In this project work the effort of restructuring an automated mechanical arm is depicted with the utilization of infrared obstruction detection and also relocation of that specific object. The incorporation of Arduino programming merged with the intelligent design approach of robotic movement of an artificial hand is the main attraction of the presented work. This gives the idea of a creation in technical field where hardware and software interfacing is done tactfully.

Keywords - Arduino programming, Artificial hand, Infrared detection, Robotic arm, Flex sensor, Servo motor.

Date of Submission: 12-03-2018

Date of acceptance: 28-03-2018

I. Introduction

In the ancient days, industrial operations were executed by human beings who required lots of effort[1]. To overcome the limitations the concept of automation evolved in industries. Till now the robotics has grabbed huge attentions throughout the world as it leads to possibilities of wide applications in numerous fields of advanced technology. Robotic arm is basically a mechanical arm, which may be manipulated to act like a human arm. Variations of robot arms depend on their range, working capability and reach etc. The pick and place[2] type jobs are normally done by spherical robots, plotting and handling arc welding type works can be performed by the Cartesian robots. The Cylindrical robots can be used to do more focused and accurate operations. Parallel robots are utilized in the mobile platform to handle cockpit flight simulators. Anthropomorphic robot acts like a human hand, with independent fingers and thumbs. A gripper is an end terminal device often used in material handling applications industrially capable of generating sufficient grip force to retain an object.

II. Methodology

Robotic arms[3] are made of properly connected mechanical parts adjusted with electronic have onboard controllers to get a smart communication. The standalone arms are often considered as independent robots. Any gripper must be able to perform the assigned job of components as a controller allowing robots to interact with the ambient systems. Many intelligent devices use opening and closing with a suggested amount of force to operate a predefined job. The fingers are moved together such that once gripped any object is centered within the gripper.

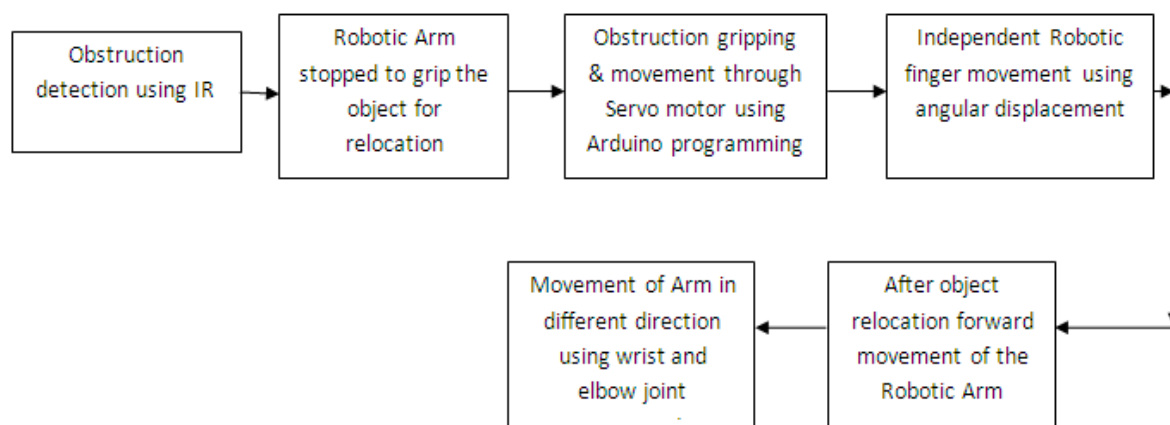


Fig.1: Block Diagram of the project work

In this project work, the IR(Infrared)[4] transceiver pair placed on the palm of the robotic arm, detects the presence of any obstruction from a certain distance present in the path of the independent robotic arm. The total idea is shown through a block diagram[Fig. 1]. The arm moves forward to the object[5] and stops there in front of it for gripping for a predefined time. Then after gripping the matter, it relocates the object from the path of the movement with the predetermined angular shifting of the arm and again continues moving forward. The output of the IR pair controls the detection of the presence of the obstacles situated in the path. After the detection of the object the signal is fed to the Arduino Uno controller board to operate the robotic arm. The automated arm shall grip the object with its specially designed gripper which will act like a human arm. The fingers of the designed arm are moved using servo motors and flex sensors. The flex sensors are attached on the fingers and these sensors provide different resistance values for different bending positions with high sensitivity. According to the movement of the fingers different range of voltage values are acquired and implemented in the programming to operate the robotic movement. The degree of freedom of the angular movement of the fingers is controlled[6] by the programming developed in the Arduino Uno controller[10] interfacing board serving as the brain of the system. The servo motors are acting like the joint motors present in the fingers of human beings.

III. Technological Backbone Of The Model

The Infrared technology[4] has a wide variety of wireless applications. When the infrared(an invisible radiant energy) radiations which are emitted from IR transmitter up to a certain range(700 nm to 1 mm), hits the object found and the resistance of the LED falls down from a high value. Then the radiation reflects at some angle and received by the receiver placed next to the IR LED. So, an infrared sensor acts as a photo-coupler or an opto-coupler which transmits and detects the infrared radiation falling on a nearby obstacle. The transmitter and the receiver should approximately be placed at an angle of 45 degree for proper object detection. In the below mentioned figure[Fig. 2], the object detection circuit is presented using NI Multisim[12].

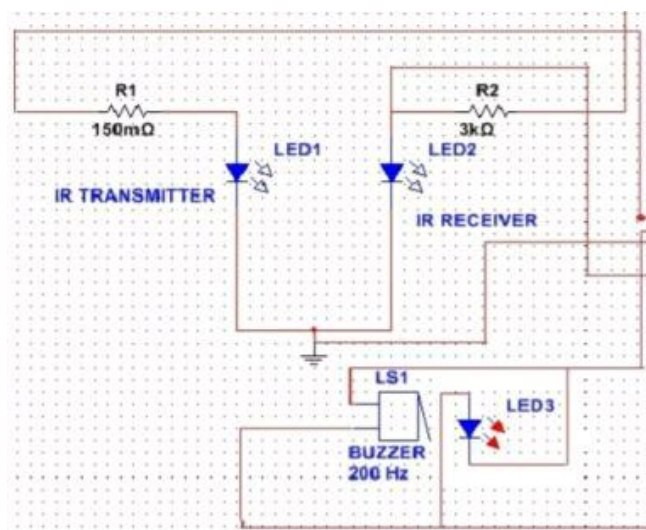


Fig.2: Circuit Diagram of the Object Detection using IR transceiver

The utilization of the IR receiver[8] has been interpreted using a LED and a buzzer as audio-visual indicator. In this case when the LED recognizes any hindrance it will turn on the output and the movement of the robotic arm will take place. Servo motors operate as DC motors with gearing and feedback control loop circuitry and no motor drivers are required. A servomotor allows for precise control of angular position. The motor is coupled to a sensor for position monitoring[9] through a reduction gearbox. Servomotors are used in robotics[7], CNC machinery or automated manufacturing. The controlling part of servo motor is connected to the output shaft allowing the control circuitry to monitor the current angle of the servo motor. Depending on the shaft angle, motor shuts off and on. The output shaft of the servo can travel around 180 degrees. In the below mentioned figure[Fig. 3], the connection between servo motor and the object detection circuit using Arduino is presented.

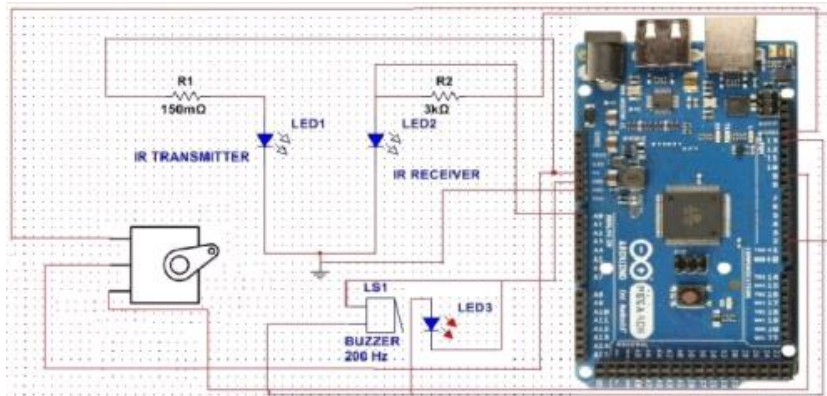


Fig. 3: Schematic diagram of the connection between servo motor and the object detection circuit

Arduino Uno[11] is the decision making open-source interfacing board. Arduino can be used to develop coordination between hardware and software for computing based on the Processing multimedia programming environment. This board requires a 5 volt linear regulator and a 16 MHz crystal oscillator.



Fig. 4: Total arrangement snapshot of the Project work while gripping

In the above figure[Fig.4], the overall hardware setup development snapshot is given when the gripper of the robotic arm is gripping the obstruction present in the path of movement.

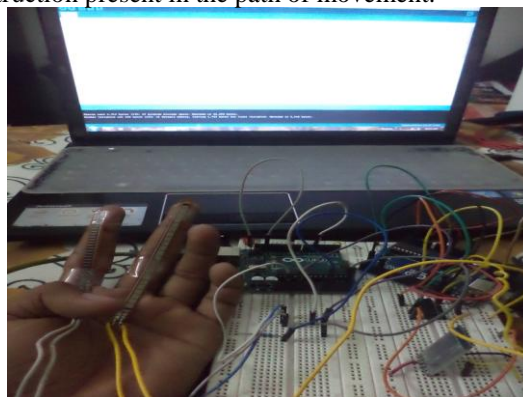


Fig. 5: Total arrangement snapshot of the Project work with flex sensor

In the above figure[Fig.5], the overall setup is shown when the flex sensor is attached on the real human fingers.

IV. Conclusion

Functionally obstruction avoidance machine is implemented by using IR detection method. This arrangement is made to all direction movement and the movement of the robotic arm has a flexible range.

V. Scope Of Improvement In Future

This will beneficially help the visually impaired people travelling inside home by giving suitable guidance. The proper implementation can improve the industrial applications. For the more advancement and

smart system development of the muscle signal operated system may be attached with the robotic fingers to make it more interactive and real with biomimics.

Acknowledgements

The authors are very much thankful to EIE Dept. for their cooperation.

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IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) is UGC approved Journal with Sl. No. 4198, Journal no. 45125.

Susmita Das. " Object Gripping With Automated Robotic Arm Movement." IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) 13.2 (2018): 48-51.