AUTONOMOUS CARGO ALIGNMENT ROBOT

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ABSTRACT

For increasing the productivity, the industries are moving from the present state of automation to robotization. This paper represents a smart approach for a real time inspection and selection of objects in continuous flow. The project deals with the autonomous material handling system. The aim of the project is to classify the colored objects which are coming on a conveyor by picking and placing the objects in its respective programmed place. Thereby accuracy and speed has been increased by eliminating monotonous work done by humans. The project involves sensors which sense the color and guide the direction which has been lined with the black tape and send signals to the microcontroller. Then the controller sends signal to the circuit which drive the various motors for gripper to grip the object and place it in the specified location. Here an adjustable gripper is used for picking and placing operation. The design methodology involves the hardware and software design and implementation of both. The pick and place robot is fully controlled by software which are programmable.

KEYWORDS: microcontroller, robotization, adjustable gripper, autonomous.

I. INTRODUCTION

A robot can be defined as a programmable, self-controlled device which contains electronic, electrical, or mechanical units. Robot is an integral part in automating the flexible manufacturing system. Robots are now more than a machine, as robots have become the solution of the future as cost labour wages and customers demand.

This helps to increase productivity, accuracy and speed. Robot and automation is employed in order to replace human to perform those tasks that are routine, dangerous, complex and in hazardous area. The most apparent reasons that are associated in installing of robotic systems in industry are;

1) Saving of manpower.
2) Improved quality & efficiency.
3) Increased consistency & flexibility.

Pick and place is one of the most famous applications which have been used widely. The automated pick and place systems mainly consist of robotic arms and sensors. This paper aims at automated material handling system. This can be done by using sensors interfaced with Micro Controller Unit. It synchronizes the movement of robotic arm to pick the objects moving on a conveyor belt.

Fig. 1: Examples of complex situations for multiple object segmentation.

A pick and place robot has been strategically programmed to pick literally any object and to place it wherever required. The pick and place operation is very common in pharmaceutical industry, electronic industry, food industry and consumer goods industry.

II. OBJECTIVES

The main objective for this study was:
a) To increase the manufacturing capacity for industries.
b) To increase the labour productivity by the redistribution of labourers in the industries.
c) Reducing the cost factor and handling time of a product.
d) To eliminate the manual based tasks and operations.

III. FUNCTIONALITY

Main functions of Project:
In this project we make line follower that move on black line and it check the black line with the help of IR and photodiode sensor. On the basis of reflection concept.

• **PICK Mode:** In this mode, we use robotic hand that make with help of two motor. system check the distance and according to distance it pick the object and place on certain distance, it move again and again pick the object on certain location.

• **Colour Mode:** In this mode, after picking the object it performs the operation of colour checking, if robot detects the WHITE colour, it place the object in right direction otherwise in left direction.

IV. DESCRIPTION OF COMPONENTS

• Microcontroller
The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.
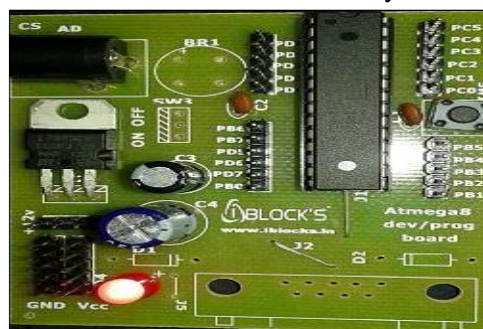

Fig. 2: Microcontroller board

The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM con-tents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.
• L293D

The L293D is an integrated circuit motor driver that can be used for simultaneous, bi-directional control of two small motors. The L293D is a quadruple high-current half-H driver designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to36 V. It is designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications .

- LCD

Fig. 3: LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

- DC MOTOR

An electric motor is an electromechanical device that converts electrical energy into mechanical energy. DC motors can be used to drive the Robot. Here the motor requires 12v geared dc motor in order to hold the book and also for movement of arm i.e., up and down. It gives movement to the robot.

- POWER SUPPLY

The input is 230v AC which is step down using an adaptor which will convert it in to 12v .The 12v ac input is fed to the bridge diode which serves as a rectifier to give 12v pulsating DC. This DC voltage is filtered through the capacitor to remove the ripples. Actually capacitor acts as low pass filter which will pass components of lower magnitude. The filtered DC is fed to 7805 regulator to fetch +5v regulated output. This regulated voltage is given to the circuit as all the components work on this voltage magnitude. With the help of different terminal ports this voltage can be used to drive different components.
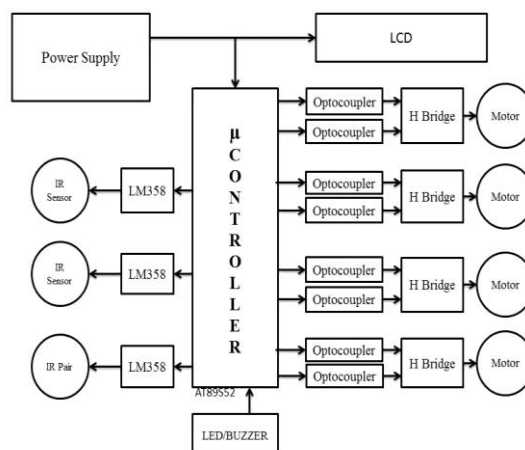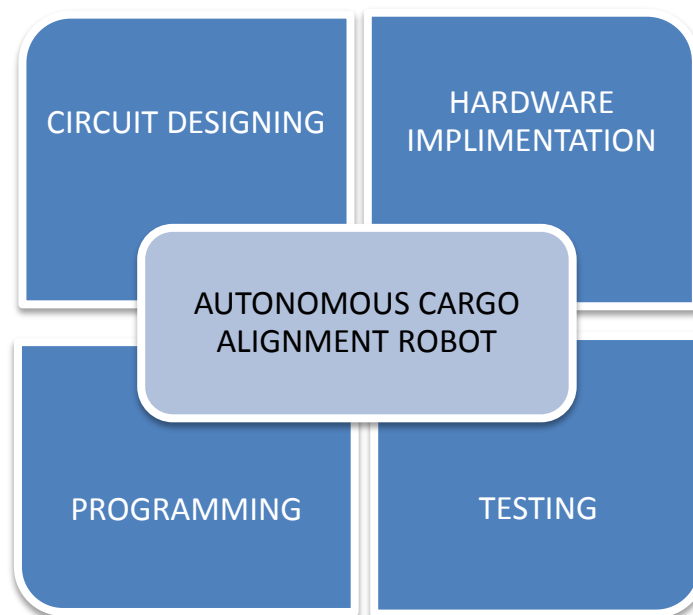
V.   BLOCK DIAGRAM

Fig. 4: Block Diagram of Autonomous Cargo Alignment Robot.

The above block diagram shows the working process of the project "AUTONOMOUS CARGO ALIGNMENT ROBOT". The microcontroller used in this project is AT89S52. The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The programming of microcontroller is done with the help of burner or programming kit. The L293D is an integrated circuit motor driver that can be used for simultaneous, bi-directional control of two small motors. LCD is used to display the result i.e; the colour of the object. LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. Optocouplers are used to drive the motors in forward and reverse direction. IR sensors are used to detect the objects on certain location.

VI.   IMPLEMENTATION & DESIGN

Fig. 5: Working Process through block diagram

The above block diagram shows the working progress of the project. The development of the project is divided in to four sections which are Circuit design, Hardware Implementation, Testing and Programming. This is a step by step procedure in which firstly pay attention towards circuit design, place the components in there suitable place with their suitable configuration after that the next step is the hardware implementation on general purpose PCB (Printed Circuit Board) and connections. When above two steps completed then next step is testing in which the testing of circuit and circuit design are performing. Last and measure step of the project is the programming of microcontroller & smart card memory so that it perform required functions. For programming the programming kit or burner is used.

VII.   CIRCUIT SIMULATION

The block diagram shows the circuit simulation of the project. The software used for simulation of the Project is Proteus design suite version 8.4. Proteus developed by Labcenter Electronics, is a software with which you can easily generate schematic. Proteus also has the ability to simulate the interaction between software running on a microcontroller and any analog or digital electronics connected to it.
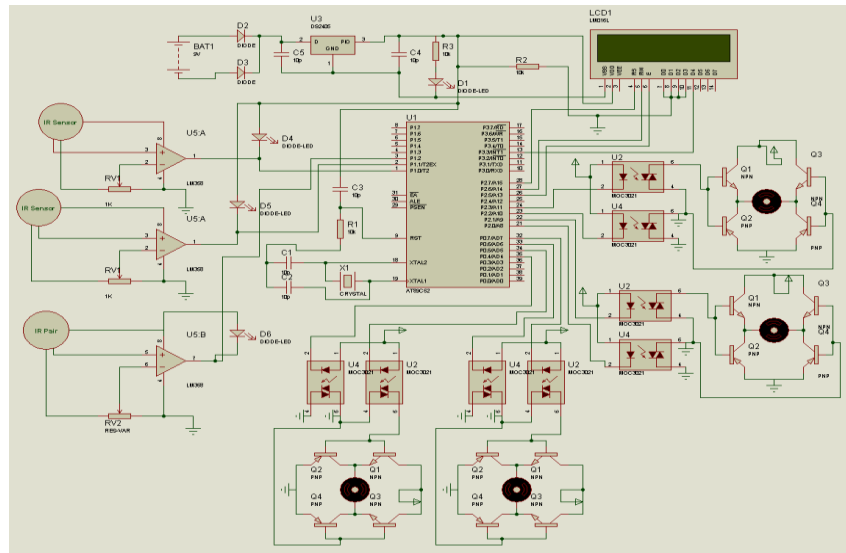
Fig. 6: Circuit Simulation of Autonomous Cargo Alignment Robot.

VIII.   RESULTS AND DISCUSSION

This project involves sorting of objects through colour sensors. The research project successfully carry out the task of identifying the colour of object and place those objects at the preprogrammed places i.e.; if robot detects the WHITE colour, it place the object in right direction otherwise in left direction, and rejects if the conditions are not met. This method is verified to be highly beneficial for automated industries. The aim of the project was to have a fully functional robotic arm which sorts different coloured objects and the target is achieved successfully. The sensor is key component of project which aides in distinguishing the objects. Failing of which may result in wrong material handling. Thus it becomes vital that the sensor had a very high sense of sensitivity and ability to distinguish between colours. The system responses are a little bit slower than expected. It can be improved by using a more advanced colour sensor and microcontroller. User interfaces also can be provided as a modification which will enable the on demand reconfiguration of the movement in a better way.

IX.   CONCLUSION

We have successfully studied about Autonomous cargo alignment Robot system. We used Line follower system with colour sensor to implement this work. The "PROTEUS" software has been used to implement the Simulation of this project. The main advantage of the system is that it does require any labour to use this Robot. At the same time Proteus software has been used to support human-computer interactions to realize multiple functions. The system is designed for elderly and disabled people so that they can monitor and control the Robot with their limited ability. Hence, the system is highly efficient and it consumes low power.

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Shuchita Saxena has 9.5 Years of experience in the field of Academic and is actively involved in research & development activities. She started her career from MIT, Moradabad. Presently she is working as an Assistant Professor of E&C Engg., at MIT Moradabad. She has published number of papers in international & national journals, conferences and seminars.

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