DESIGN OF AN AUTOMATED SORTING OF OBJECT REJECTION AND COUNTING MACHINE

Kaushal Pratap Singh*, Priyanka singh**
*Jaypee University of Information Technology, Samirpur, Hamirpur-HP (India)
** Sambhram Institute of Technology, M.S.Palya, Jalahalli East, Bangalore, Karnatka-560097

Abstract

The paper presents an effective solution for determining characteristic features of objects from a simple measurement set-up. A low-cost IR diode array, working on a reflection light scanner principle, has been designed. Essentially arrays of several emitter-receiver pairs are mounted on different sides of the area of observation, enabling the estimation of the size of the object in different dimensions and its reflection coefficient. The emitters are driven successively in time; hence no signal overlapping and cross-talk occur. The results show that from simple light intensity measurements, a variety of objects can be reliably recognized. As an example, the problem of determining the number of people getting into or out of a room is addressed. Two arrays of 3 diode pairs each are mounted on both sides of a doorway. With the proposed sensor, people can be recognized easily and are well separable from other echoes (motion of hands etc.), making the performance far more reliable than that of ordinary light barriers.
Keywords – IR diode array, Sensor, Emitter-Receiver.

1. INTRODUCTION

Auto-motion first opened its doors in 1967 as a distributor of conveyors and conveyor accessories. It did not take long to realize that one could provide far greater service to the customers if one could also control the manufacturing aspects of the conveyor equipment. Auto-motion understood the value of providing service in every faces from design and production to installation, training and ongoing factory trained technical support. Though it is suggested that ancient civilizations such as the Egyptians used conveyors in major construction projects and history of the modern conveyor dates back to the late 17th century. These early conveyor systems were typically composed of a belt that travelled over a flat wooden bed. The belt was usually made from leather, canvas or rubber and was used for transporting large bulky items. Hymle Goddard of Logan Company patented the first roller conveyor in 1908. In 1919, the first powered and free conveyors were introduced into the mass production of automobiles. The application of the conveyor branched out to coal mining in the 1920s, where the technology underwent considerable changes. Conveyor belts were designed made of layers of cotton and rubber coverings. During the manufacturing increase of World War II, manufacturers created synthetic materials to make belting because of the scarcity of natural components. Today's conveyor belting is made from an almost endless list of synthetic polymers and fabrics and can be tailored to any requirements. Possible uses of conveyors have broadened considerably since the early days and they are used in almost any industry where materials have to be handled, stored or dispensed. The longest conveyor belt currently in use operates in the phosphate mines of the Western Sahara and is over 60 miles long. With the increasing demand in the market, many synthetic polymers and fabrics began to be used in the manufacture of conveyor belts. Today, cotton, canvas, EPDM, leather, neoprene, nylon, polyester, polyurethane, urethane, PVC, rubber, silicone and steel are commonly used in conveyor belts. Nowadays, the material used for making a conveyor belt is determined by its application

2. LITERATURE REVIEW

Tsalidis et al. [1] describes in this paper that conveyor belt design is examined as an application of a proposed Design Parameters Space Search technique. First, the main characteristics of the belt-conveyor design process are presented as they appear in the current literature. Furthermore, a proposed general knowledge-representation platform is described, and its ability to house the relevant conveyor design knowledge is also shown. The extended search technique of the design space is discussed, and an integrated example of a belt-conveyor design is presented, based on the proposed representation platform and the extended search technique. Huang et al. [2] describes in this paper deals with the time-minimum trajectory planning of a 2-DOF translational parallel robot named the Diamond for rapid pick-and-place operations. Kinematics and dynamics of the robot are formulated using a parametric function, allowing the representation of the input torque and velocity constraints to be converted to those in terms of the path length. A modified algorithm for achieving the minimized traversal time is proposed by taking into account the path jerk limit. Lithium-ion battery sorting using the Diamond robot is taken as an example to demonstrate the applicability of this approach. Dogan Ibrahim et al [3] aim to show the special features of the C language when programming microcontrollers. He says that the industry standard C51 optimizing C compiler is used throughout. This compiler has been developed by Keil Elektronik GmbH. C51 is available on both MS-DOS and Windows-based operating systems and the compiler implements the American National Standards Institute (ANSI) standard for the C language. There are many other high-level language compilers available for microcontrollers, including PASCAL, BASIC, and other C compilers. Some of these compilers are freely available as shareware products and some can be obtained from the Internet with little cost. These compilers can be used for learning the features of a specific product and in some cases small projects can be developed with such compilers. The C51 compiler has been developed for the 8051 family of microcontrollers. This is one of the most commonly used industry standard C compilers for the 8051 family, and can generate machine code for most of the 20-pin and 40-pin 8051 devices and its derivatives, including the following microcontrollers: Intel and others 8051, 80C51, and 87C51 Atmel 89C51, 89C52, 89C55, 89S8252, and 89S53.Sahu, et al.[4] describes the outline of the development of the colour sensor meant for the radiation-robot used for the alignment of sample for various experiments in a radiation environment near nuclear beam line of 3MV Tandem pelletron Accelerator at Institute of Physics, Bhubaneswar. In this paper a comparative study between the APD and LDR for their sensitivity towards different colours also discussed. A cost effective as well as with reasonable accuracy and precision, a colour sensor is developed with a array of LDRs, where the biasing voltage is very less compared to APD based colour sensor. This sensor is used in a micro-controller based object rejecter and successfully able to distinguish 8 colours. This can be enhanced to 256 colours. This work is the first developmental stage of the robot, which will be used for alignment of the sample sensing laser of different colour in high-dose radiation environment. Khojastehnazhand et al. [5] Grading systems give many kinds of information such as size, colour, shape, defect, and internal quality. Among these colour and size are the most important features for accurate classification and/or sorting of citrus such as oranges, lemons and tangerines. Basically, two inspection stages of the system can be identified: external fruit inspection and internal fruit inspection. The former task is accomplished through processing of colour images, while internal inspection requires special sensors for moisture, sugar and acid contents. In this paper, an efficient algorithm for grading lemon fruits is developed and implemented in visual basic environment. The system consists of two CCD cameras, two capture cards, an appropriate lighting system, a personal computer and other mechanical parts. The algorithm initially extracts the fruit from the background. The samples of different grades of lemon are situated in front of the cameras and are calibrated off-line. Then information on the HSI colour values and estimated volumes of fruits are extracted and saved in a database. By comparing the information during sorting phase with the available information inside the database, the final grade of the passing fruits is determined. This algorithm can be easily adapted for grading and/or inspection of other agricultural products such as cucumber and egg plant.

3. METHODOLOGY

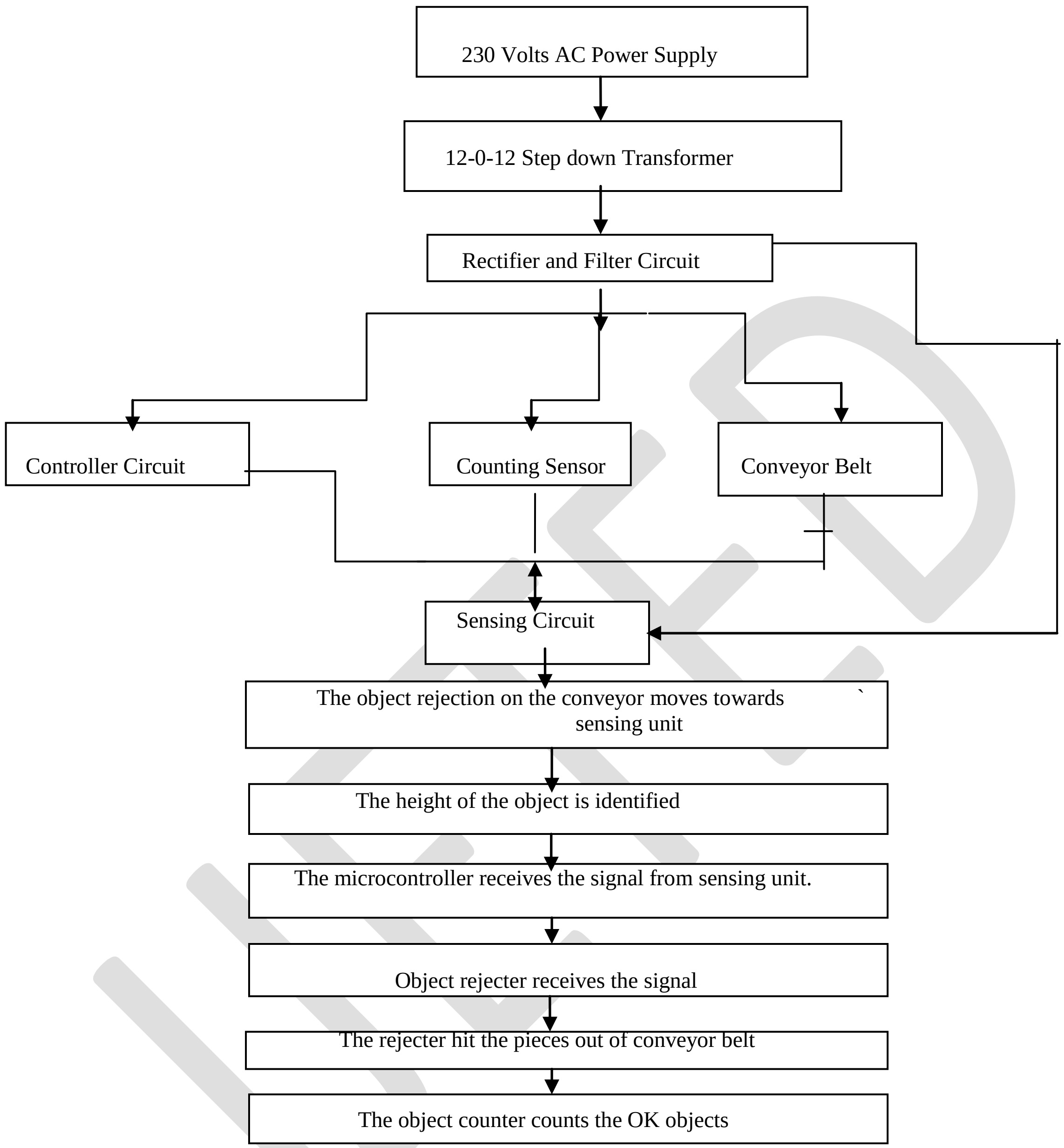


Fig.1 Methodology

The working of object sorting system using height sensor and digital counter is described in steps as follows:
Objects on the running conveyor are classified into two categories based on the height. When the object passes through the sensing circuit it identifies the height of the object on the conveyor and sends signals to the micro-controller.

3.1.1 Sensing Circuit

This circuit can be used to sense and differentiate between different heights. This circuit demonstrates the principle and operation of a simple height sensor using LDR. The circuit is divided into three parts: Detector (LDR), Comparator and Output. When light of a particular color fall on LDR, its resistance decreases and an output voltage is produced. This voltage is dependent on the intensity and wavelength of different color.

3.1.2 Transformer

A transformer is a static device that transfers electrical energy from one circuit to another through inductively coupled conductors through the transformer's coils. A varying current in the first or primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic field through the secondary winding. This varying magnetic field induces a varying electromotive force (EMF) or "voltage" in the secondary winding. This effect is called mutual induction.

3.1.3 Rectifiers Circuit

The signals from the micro-controller are then given to the object rejecter through the switching circuit. These signals will control the arm and rejecter movement and will place the object picked from conveyor belt to three different places in order to segregate them. The switching circuit gives the option of manual operation of arm movement as well as rejecter operation. The automation switch on the board will operate the system automatically.
A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which is in only one direction, a process known as rectification. A full-wave rectifier is used, which converts the whole of the input waveform to one of constant polarity (positive or negative) at its output. Full-wave rectification converts both polarities of the input waveform to DC (direct current), and is more efficient.6A diodes are used for voltage rectification. Therefore the AC voltage is now converted pulsating DC. While half-wave and full-wave rectification suffice to deliver a form of DC output, neither produces constant-voltage DC. In order to produce steady DC from a rectified AC supply, a smoothing circuit or filter is required. This pulsation is removed by 1000micro-farad capacitor filter circuit. Sizing of the capacitor represents a tradeoff. For a given load, a larger capacitor will reduce ripple but will cost more and will create higher peak currents in the transformer secondary and in the supply feeding it. In extreme cases where many rectifiers are loaded onto a power distribution circuit, it may prove difficult for the power distribution authority to maintain a correctly shaped sinusoidal voltage curve. The output of the filter circuit is pure DC which is then supplied to controllers, motors and sensors.

3.1.4 Relays

A relay is an electrically operated switch. Relays are used where it is necessary to control a circuit by a low-power signal or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays were used extensively in telephone exchanges and early computers to perform logical operations. A type of relay that can handle the high power required to directly control an electric motor is called a contractor. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults. In modern electric power systems these functions are performed by digital instruments still called "protective relays". In this system DC Motors for rejecter, turn table, object rejecter and conveyor belt are connected through the relay circuit.

3.1.5 DC Motors

The DC motors are used to control the conveyor belt and object a rejecter movement are connected to controller circuit and receives signals from micro-controller. There are IR sensors installed in order to accurately identify ground and drop places. An electric motor converts electrical energy into mechanical energy. DC motor design generates an oscillating current in a wound rotor, or armature, with a split ring commutator, and either a wound or permanent magnet stator. A rotor consists of one or more coils of wire wound around a core on a shaft; an electrical power source is connected to the rotor coil through the commutator and its brushes, causing current to flow in it, producing electromagnetism.

3.1.6 Conveyor Belt and Object Rejecter

Object Rejecter: 9V, 60 rpm, DC motor is used to control the rejecter movement, for throwing/pushing out of the line. The DC motor receives its signal from the controller for performing sensing and pushing operations. The rejecter has been specially designed in order to push over height objects from the running conveyor and pushing them at programmed locations.

3.1.7 Conveyor Belt

A conveyor belt consists of two or more pulleys, with a continuous loop of material - the conveyor belt - that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler. There are two main industrial classes of belt conveyors; those in general material handling such as those moving boxes along inside a factory and bulk material handling such as those used to transport industrial and agricultural materials, such as grain, coal, ores, etc. generally in outdoor locations.

3.1.8 Infrared Array

The optical system consists of n pairs of a highly directional IR emitter diode and a shielded sensitive phototransistor, located close to one another. Due to the face-to-face mounting, the maximum range R_{max} can be reduced to almost the half of typical door widths what is still challenging for the detection of some materials and dark colors. A high transmitter power is one of the key elements. Pulsed emitter diodes sfh 415-u diodes With Integrated preamplifier and a maximum sensitivity at Approx. 950 nm have been chosen. The emitters are driven at temporally successive instances, hence overlapping and mutual influence of the echo signals is excluded. All received impulses are then demultiplexed into one channel. The processing is performed on a low-power 8 bit micro-controller which generates the pulses, handles the timing of Emission, determines and stores the received echo features and makes the decision about the object. For the specific application as a people counter, two Arrays will be mounted vertically on both sides of the Doorway, containing each n=3 pairs of transmitter and receiver diodes ('sensors'). Hence, the plain of Observation will be horizontal. In order to gain a time Dependency of the measured amplitudes in the Direction of object motion, the pairs are inclined outwards, see fig. 2. For a larger number of emitter receiver pairs, even larger angles can be monitored And the resolution can be improved In order to detect and classify objects in their of Observation (persons in a doorway in particular), it is Proposed to mount small infrared diode arrays, Working on a reflection light scanner principle, on Both sides of such objects, see fig. 1. Due to range Information from different angles of observation, the Ambiguity of light intensity contributions from the Range of the object from the light source and its Reflectivity can be solved. The recognition is then Based on the exploitation of model assumptions and
Additional knowledge learned during operation. No Moving parts are applied and all components are very Tiny and cheap.

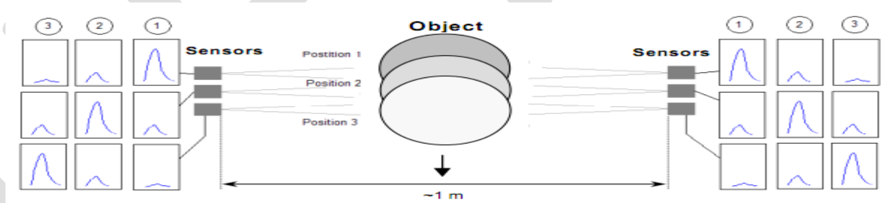


Fig. 1. Basic configuration of the detector and amplitudes of the output signals for different object positions 1,2 3 (left and right columns), illustrating the working principle

3.1.9 Infrared Object Counter

This infrared object counter can be installed at the entry gate to count the total number of people entering any venue. For example, it can be used at the railway stations or bus stands to count the people arriving per day or week. The counter uses an infrared transmitter-receiver pair and a simple, low cost calculator. It works even in the presence of normal light.. No focusing lens is required. If an 8-digit calculator is used the counter can count up to 99,999,999 easily, and if a 10-digit calculator is used the counter can count up to 9,999,999,999. Powered by a 9V battery, the transmitter circuit (see Fig. 1) comprises IC 555 (IC1), which is wired as an stable multi vibrator with a centre frequency of about 38 kHz, and two infrared light-emitting diodes (LEDs). The receiver circuit (see Fig. 2) is powered by a 5V regulated power supply built around transformer X1, bridge rectifier comprising diodes D1 through D4 and regulator IC2. It uses an infrared receiver (IR) module (RX1), opt coupler (IC3) and a simple calculator. When switch S1 is in 'on' position, the transmitter circuit activates to produce a square wave at its output pin 3. The two infrared LEDs (IR LED1 and IR LED2) connected at its output transmit modulated IR beams at the same frequency (38 kHz). The oscillator frequency can be adjusted using preset VR1.In the receiver circuit, IR receiver module TSOP1738, which is commonly used in color televisions for sensing the IR signals transmitted from the TV remote, is used as the sensor. The IR beams transmitted by IR LED1 and LED2 fall on infrared receiver module IR RX1 of the receiver circuit to produce a low output at its pin 2. This keeps transistor T1 in non conduction mode. Now when any one enters through the gate to interrupt the IR beam, the IR receiver module produces a high output pulse at its pin 3. As a result, transistor T1 conducts to activate IC3 .Both the transmitter and the receiver can be assembled on any general purpose PCB. For installation, switch off the transmitter, receiver and calculator, and mount the transmitter and the receiver on the opposite pillars of the main entry gate such that they are properly orientated towards each other. Mount the calculator where you can read it easily. Connect pins 4 and 5 of IC3 across '=' key connections on the PCB of the calculator. Now switch on the transmitter and the receiver by pressing switches S1 and S2, respectively. Thereafter, switch on the calculator and press '1' followed by '+' key of the calculator to initialize it. Now your counter is ready to count. The calculator reads '1' after one interruption, '2' after second interruption and so on

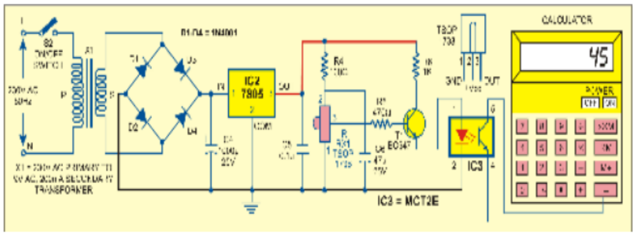


Fig. 2: Receiver-cum-counter circuit

4. EXPERIMENTAL SETUP

4.1 Conveyor System

4.1.1 Frames

Standard gravity conveyor frame widths are 305 mm, 460 mm and 610 mm overall. Conveyor frames are stocked in both 1.5 meter and 3 meter lengths. Frames are supplied with either "butting plates" (standard) or hook and bar attachments to secure each segment together

4.1.2 Rollers

Standard rollers for the conveyor frames are 50.8 mm diameter. They are available in PVC (25kg capacity), Black Steel and Galvanized Steel in both Medium Duty (140 kg capacity) and Heavy Duty (200 kg capacity) versions to suit varying loads or conditions. Stainless steel rollers for wash-down or corrosive applications are used. Spring loaded axles slot into holes along the frame. On PVC and Medium Duty rollers one end is a D shape whilst the other is round. This allows for easy replacement of damaged rollers.

4.1.3 Supports

Two types of standard supports are available. Both styles provide adjustment from 600 – 1000mm to "Top of Roller". Other support styles and complete frames are used to special support. RHS Supports are bolted to the underside of the conveyor frame via a crescent (smiley) plate. This plate provides allowance for any angular misalignment. Normally, supports are only placed on every conveyor join (3 stands for 2 frames). Curves always require 2 stands for proper stability.

4.1.4 Belt Conveyor

A conveyor style utilizes a flat belt running on a flat fabricated steel deck or over rollers. They are used where smooth and quiet transport of product is desirable, and is ideally suited to irregular shaped product that cannot easily be moved on other conveyor styles.

4.1.5 Line Shaft Conveyor Systems

Line shaft is an economical method of conveying flat bottomed product. A series of rollers, each driven by a polyurethane band connected to a single rotating shaft, mounted within the conveyor body, drive the product through the system. Line shaft conveyors are made as standard in widths of 245mm, 398mm and 550mm (measured between frames).It provides minimum pressure accumulation, quiet operation and easy installation. It is suitable for transportation of products within warehouse or manufacturing operations where lighter weight cartons, tote bins and other products need to be moved, allowing for a variety of situations requiring directional changes. Limited, minimal pressure accumulation of product can be obtained with this style of conveyor.

4.1.6 Conveyor System

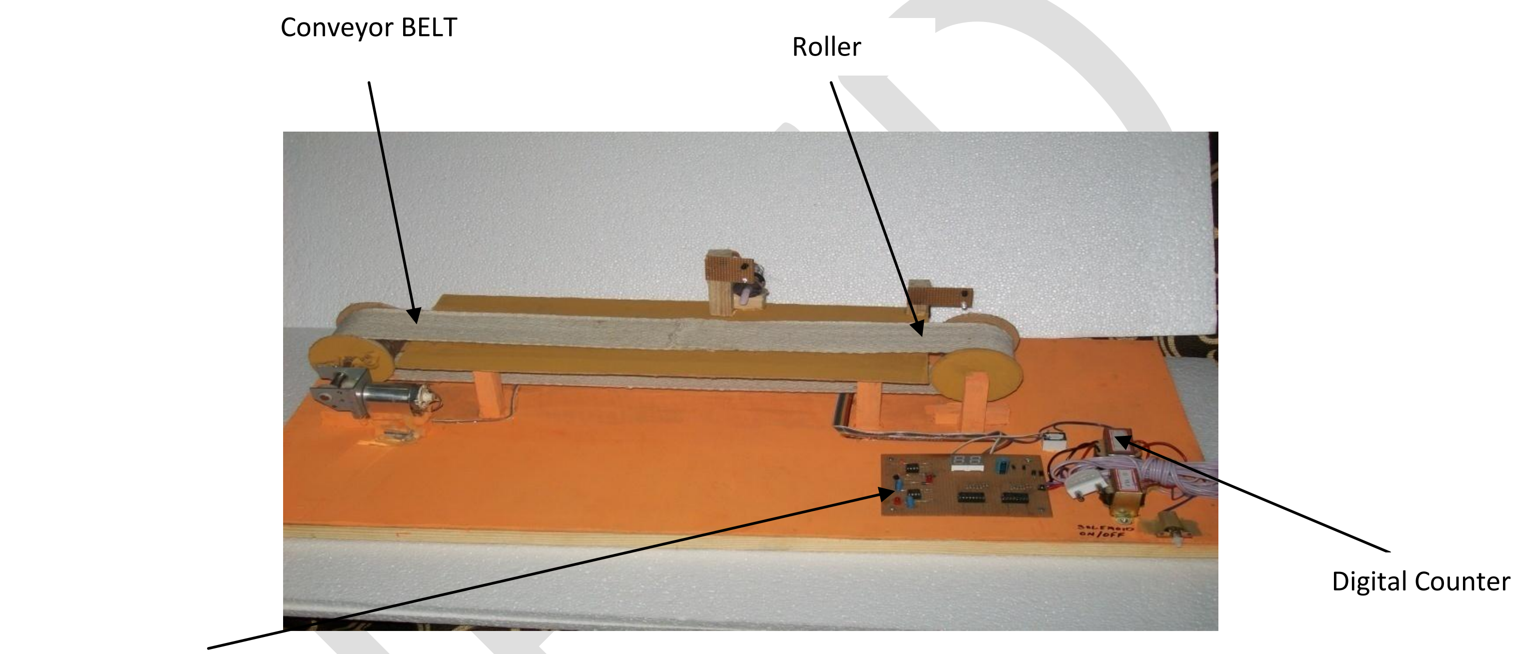
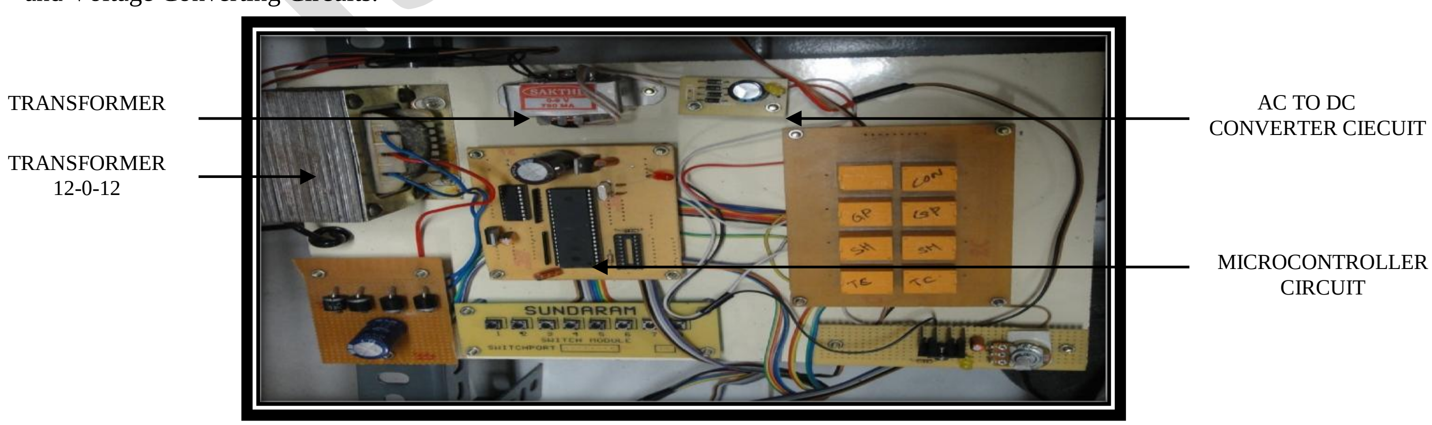


Fig. 3.1 Conveyor system

5. ELECTRONIC CIRCUITS

5.1 Electronic Module

Figure.5.1 represents Electronic Module contains Microcontroller circuit, Relay Circuit, Infrared Sensors and Voltage Converting Circuits.



5.2 Interfacing of Microcontroller to Relay Circuit by Darlington Array (ULN Driver)

One option for driving relays would be to use a high-voltage, high-current, Darlington array driver IC such as the ULN2803. The ULN2803 can directly interface to the data outputs of the 8051 pins, and provides much higher drive-current. The ULN2803 also has internal diode protection that eliminates the need for the fly-back diode as shown in the above relay driver schematics. One can connect 8 relay using this IC. It is always best connecting the switch to ground with a pull-up resistor as shown in the "Good" circuit. When the switch is open, the 10k resistor supplies very small current needed for logic 1. When it is closed, the port pin is short to ground. The voltage is 0V and the entire sinking current requirement is met, so it is logic 0. The 10k resistor will pass 0.5 mA (5 Volt/10 k ohms). The drawback is that the closure of switch gives logic 0 and people like to think of switch closure gives logic 1. The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays. It consists of seven NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diode for switching inductive loads. The collector-current rating of a single Darlington pair is 500mA. The Darlington pairs may be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED gas discharge), line drivers, and logic buffers. The ULN2003 has a 2.7kW series base resistor for each Darlington pair for operation directly with TTL or 5V CMOS devices. The ULN driver details are shown in Fig. 5.2.

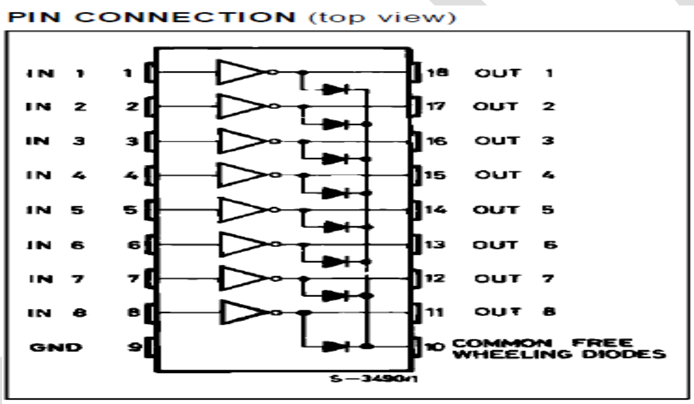


Fig. 5.2 ULN 2803

5.3 Relay Driving Circuit

This project uses relay circuit board to control various parameters of project. It uses 8 relay boards. The relay acts as a switch for parameters like turn table, shoulder of robot and rejecter. A relay is usually an electromechanical device that is actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit. Relays are like remote control switches and are used in many applications because of their relative simplicity, long life, and proven high reliability. Although relays are generally associated with electrical circuitry, there are many other types, such as pneumatic and hydraulic. Input may be electrical and output directly mechanical, or vice versa. Generally relay coils are designed to operate from a particular supply volt. Small relay have operation between 12V and 5V.

5.3.1 Operation of Relay

All relays contain a sensing unit, the electric coil, which is powered by AC or DC current. When the applied current or voltage exceeds a threshold value, the coil activates the armature, which operates either to close the open contacts or to open the closed contacts. When a power is supplied to the coil, it generates a magnetic force that actuates the switch mechanism. The magnetic force is, in effect, relaying the action from one circuit to another. The first circuit is called the control circuit; the second is called the load circuit. Figure 5.3 gives the internal detail of relay circuit and Fig 4.4 shows eight relay circuit diagrams with ULN driver which drives the various motors of Robotic Arm. There are three basic functions of a relay: On/Off Control, Limit Control and Logic Operation.

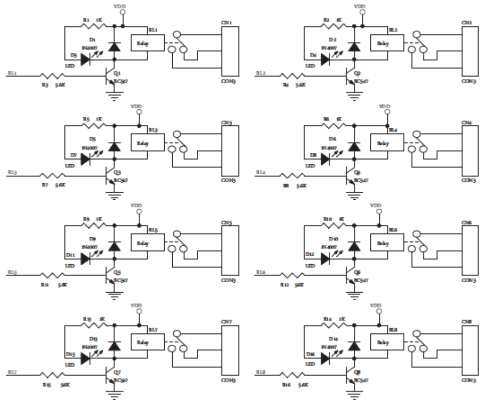


Fig. 5.3 Eight Relays Circuit

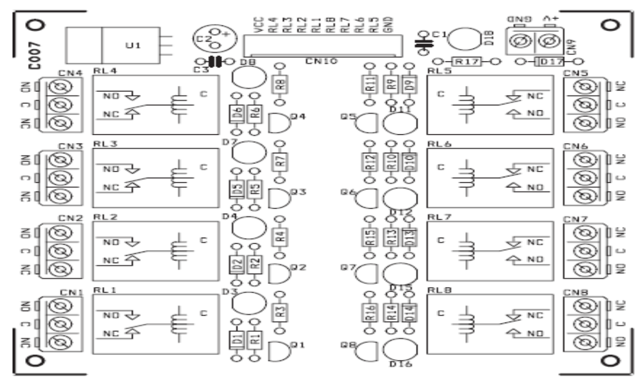


Fig. 5.4 Eight relay circuit diagram with ULN driver

5.4 Infra Red (I.R.) Sensing Circuit

LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000 000 ohms.

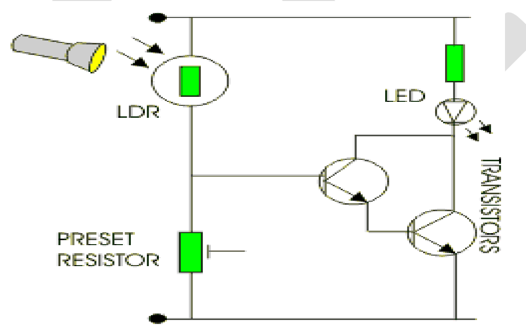


Fig. 5.4 LED based LDR Sensor

When the light level is low the resistance of the LDR is high. This prevents current from flowing to the base of the transistors. Figure 5.4 shows LED based LDR Sensor, However, when light shines onto the LDR its resistance falls and current flows into the base of the first transistor and then the second transistor. The preset resistor can be turned up or down to increase or decrease resistance. The LEDs are water clear when turned off. Black electrical tape surrounds the photocell in the centre of the LEDs. The tape blocks the direct light from the LEDs from reaching the photocell, thus detecting only reflected light. After the amount of red light, green light, and blue light is measured, each component is individually scaled based on minimum and maximum values obtained at calibration. The object whose colour is required to be detected should be placed in front of the system. The light rays reflected from the object will fall on the three convex lenses which are fixed in front of the three LDRs. The convex lenses are used to converge the light rays. This helps to increase the sensitivity of LDRs. Blue, green and red glass plates (filters) are fixed in front of LDR1, LDR2 and LDR3 respectively. When reflected light rays from the object fall on the gadget, the coloured filter glass plates determine which of the LDRs would get triggered. When a primary coloured light ray falls on the system, the glass plate corresponding to that primary colour will allow that specific light to pass through Fig 4.7. But the other two glass plates will not allow any light to pass through. Thus only one LDR will get triggered and the gate output corresponding to that LDR will become logic 1 to indicate which colour it is. Similarly, when a secondary coloured light ray falls on the system, the two primary glass plates corresponding to the mixed colour will allow that light to pass through while the remaining one will not allow any light ray to pass through it. As a result two of the LDRs get triggered and the gate output corresponding to these will become logic 1 and indicate which colour it is. The LDR is mounded in a tube, behind a lens, and aimed at the object. The colored glass filter should be fixed in front of the LDR as shown in the figure 5.5. Make three of that kind and fix them in a suitable case. Adjustments are critical and the gadget performance would depend upon its proper fabrication and use of correct filters as well as light conditions.

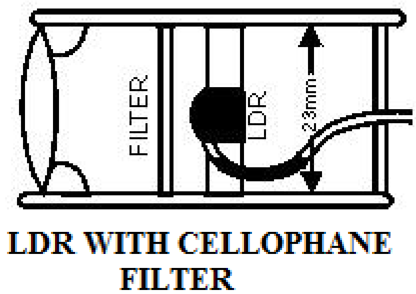


Fig. 5.5 LDR with cellophane filter

4.5 Infra Red (I.R.) Sensing Circuit

4.5.1 Object Detection Using IR Light

It is the same principle in ALL Infra-Red proximity sensors. The basic idea is to send infra red light through IR-LEDs, which is then reflected by any object in front of the sensor. This is an electrical property of Light Emitting Diodes (LEDs) which is the fact that a led produces a voltage difference across its leads when it is subjected to light (Fig 5.6). As if it was a photo-cell, but with much lower output current. In other words, the voltage generated by the led can't be in any way used to generate electrical power from light, it can barely be detected. That’s why as one will notice in the schematic, Op-Amp (operational Amplifier) will accurately detect very small voltage changes. Both the sender and the receiver are constructed on the same board.

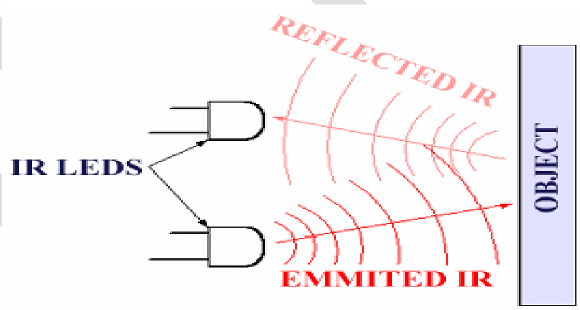


Fig 5.6 I.R. Sensing logic

4.5.2 Sensor on Technique

As the name implies, the sensor is always ON, meaning that the IR led is constantly emitting light. This design of the circuit is suitable for **counting objects**, or **counting revolutions** of a rotating object, that may be of the order of 15,000 rpm or much more. However this design is more power consuming and is not optimized for high ranges. in this design, range can be from 1 to 10 cm, depending on the ambient light conditions. As one can see the schematic is divided into 2 parts the **sender** and the **receiver**. The anode of the IR LED (here, this led will be used as a sensor). When IR light falls on the LED (D1), the voltage drop increases, the cathode's voltage of D1 may go as low as 1.4V or more, depending on the light intensity. This voltage drop can be detected using an Op-Amp (operational Amplifier **LM358**). One will have to adjust the variable resistor (POT.) R8 so the voltage at the positive input of the Op-Amp (pin No. 5) would be somewhere near 1.6 Volt. If one understands the functioning of Op-

Amps, one will notice that the output will go high when the volt at the cathode of D1 drops under 1.6. So the output will be high when IR light is detected, which is the purpose of the receiver (Fig 4.10).

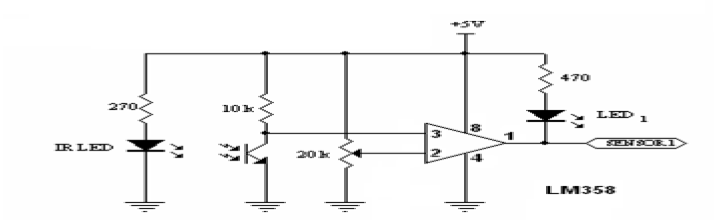


Fig 5.7 I.R. Sensor

An **Infrared sensor** is an electronic device that measures infrared (IR) light radiating from objects in its field of view. PIR sensors are often used in the construction of PIR-based motion detectors apparent motion is detected when an infrared source with one temperature, such as a human, passes in front of an infrared source with another temperature, such as a wall. All objects above absolute zero emit energy in the form of radiation. Usually infrared radiation is invisible to the human eye but can be detected by electronic devices designed for such a purpose. The term *passive* in this instance means that the PIR device does not emit an infrared beam but merely passively accepts incoming infrared radiation. “Infra” meaning below the ability to detect it visually, and “Red” because this colour represents the lowest energy level that one’s eyes can sense before it becomes invisible. Thus, infrared means below the energy level of the colour red, and applies to many sources of invisible energy. This sensor can be used for most indoor applications where no important ambient light is present. However, this sensor can be used to measure the speed of object moving at a very high speed, like in industry or in tachometers. In such applications, ambient light ignoring sensor, which rely on sending 40 KHz pulsed signals cannot be used because there are time gaps between the pulses where the sensor is 'blind’. The solution proposed doesn't contain any special components, like photo-diodes, photo-transistors, or IR receiver ICs, only a couple if IR led, an Op amp, a transistor and a couple of resistors (Fig. 5.8).

Fig. 5.8 I.R.Sensing unit.

4.6 Voltage Convertor Circuit

Many electronic devices, from computers to TVs to cell phone chargers, require various DC (direct current) voltages to supply power to their circuitry. For those appliances and devices that get their power by plugging them into an electrical wall outlet, a circuit must be designed to convert the 120 volt AC power to a desired DC voltage. Alternating current, as is found in your home's electric outlets, changes polarity 60 times a second, referred to as "60 Hertz," or "60 cycles". The voltage increases from zero to its maximum positive voltage and then swings below zero to its maximum negative voltage, in a smooth sine wave transition. In a DC voltage supply, the polarity remains constant; plus (+) and minus (-) polarity points do not change, as with a flashlight battery. Use one semiconductor diode to obtain a DC voltage from an AC source. Simply place the diode in one of the two legs of the incoming AC source. One side of a diode is the "anode" or positive side, and the other is the "cathode" or negative side. When the leg of the AC source is connected to the anode of the diode goes positive, the diode allows current to flow through. Placing a volt meter on the cathode side will register the positive voltage present. As the leg connected to the diode's anode turns negative during the AC cycle, the diode acts as a block, and does not let the negative voltage through. Thus, the "output" on the cathode side of the diode will always be positive. While this simple "rectifier" or "AC to DC converter" circuit helps explain how a diode works as a rectifier, the circuit only recovers half of the AC voltage cycle. Also, although the circuit's output is only positive, there is no output during the negative half of the input cycle. Connect two diodes to the output of a transformer that has a "centre tap" such that both the positive and negative part of the AC cycle are converted. Often, a step-down transformer is used to change the 120 volts from the wall outlet down to a voltage needed by the device. Transformers and diode combinations are used in "wall warts" or power adaptors, many of which are probably around your home for cell phone chargers and phone answer machines. In a two-diode configuration, connect the anode end of a diode on one leg of the transformer and also connect the anode end of a second diode to the other transformer leg. The transformer must have a "centre tap" connection. This will be the "ground" or negative connection. Connect the cathode end of both diodes together. This will be the positive DC output connection. Place an electrolytic capacitor across the DC output of the rectifier circuit using either the two-diode or four-diode configuration--to further smooth out the DC voltage created by the full wave rectifier. Observe the polarity of the capacitor, connecting the positive end to the positive output of the rectifier circuit, and the negative end to the ground, or minus, connection--which is the transformer's centre tap in the case of a bridge rectifier. The voltage rating on the capacitor must be higher than the DC output voltage--with no "load" connected. Formulas have been devised to calculate the best capacitance value, but generally, a large capacitor value will reduce ripple significantly. Start by experimenting with a value of 100 microfarads for a circuit with a 12 volt output. An oscilloscope can be used to see the effect of a capacitor on ripple smoothing. Figure 5.9 shows voltage convertor circuit which converts 220V to 35V.

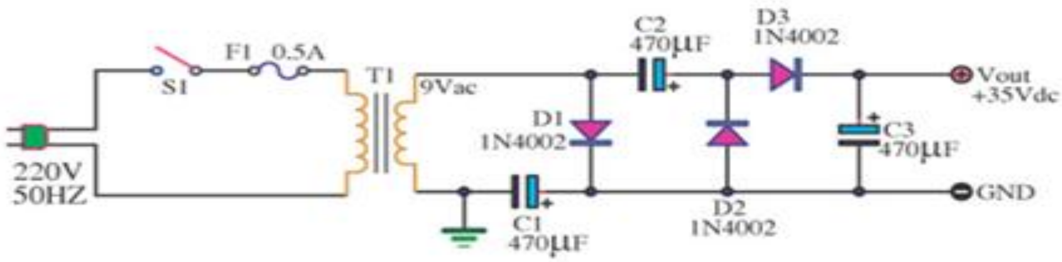


Fig 5.9 Voltage convertor circuit

6. FUTURE WORKS

This project involves the sorting of objects through color sensors the future advancements can be done by increasing the efficiency of the color sensor. 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 colors. Another area of improvement is design of efficient rejecter of Digital Image Processing (DIP) is a multidisciplinary science. The applications of image processing include: astronomy, ultrasonic imaging, remote sensing, medicine, space exploration, surveillance, automated industry inspection and many more areas. Different types of an image can be discriminated using some image classification algorithms using spectral features, the brightness and "color" information contained in each pixel. The Classification procedures can be "supervised" or "un supervised". With supervised classification, identified examples of the Information classes (i.e., land cover type) of interest in the image. These are called *"training sites"*. The image processing software system is then used to develop a statistical characterization of the reflectance for each information class. Genetic algorithm has the merits of plentiful coding, and decoding, conveying complex knowledge flexibly. An advantage of the Genetic Algorithm is that it works well during global optimization especially with poorly behaved objective functions such as those that are discontinuous or with many local minima. MATLAB genetic algorithm toolbox is easy to use, does not need to write long codes, the run time is very fast and the results can be visual. The aim of this work was to realize the image classification using Matlab software. Matlab is a widely used software environment for research and teaching applications on robotics and automation, mainly because it is a powerful linear algebra tool, with a very good collection of toolboxes that extend Matlab basic functionality, and because it is an interactive open environment. The paper presents a toolbox that enables access to real robotic and automation (R&A) equipment from the Matlab shell. If used in conjunction with a robotics toolbox it will extend significantly their application, i.e., besides robotic simulation and data analysis the user can interact on-line with the equipment. Personal experience with this tool shows its usefulness for research applications, but also for teaching projects. With students, using Matlab means taking advantage of the reduced training required to start using it, if compare with other programming environments and languages that can also be used (Microsoft Visual C++ or Visual Basic). The objective of the approach are; firstly to sort the objects by their colors precisely; secondly to detect any irregularity of the colors surrounding the apples efficiently. An experiment has been conducted and the results have been obtained and compared with that has been performed by human sorting process and by color sensor sorting devices. Existing sorting method uses a set of inductive, capacitive and optical sensors do differentiate object color. Advanced mechatronics color sorting system solution with the application of image processing. Supported by Open CV, image processing procedure senses the circular objects in an image captured in real time by a webcam and then extracts color and position information out of it. This information is passed as a sequence of sorting commands to the manipulator that does pick-and-place mechanism. Extensive testing proves that this color based object sorting system works 100% accurate under ideal condition in term of adequate illumination, circular objects' shape and color. The circular objects tested for sorting are silver, red and black. For non-ideal condition, such as unspecified color the accuracy reduces to 80%.

7. CONCLUSION

The project works successfully and separates different heighted objects using HEIGHT sensor. The height sensor result was converted chiefly to the command that drive the handling systems which drive the reject and count machine to pick up the object and place it into its designated place. There are two main steps in height sensing part, objects detection and height recognition. The system has successfully performed handling station task, namely pick and place mechanism with help of height sensor. Thus a cost effective Mechatronics system was designed using the simplest concepts and efficient result was being observed. This system is a depicting the prototype of sorting systems which are used in industries.

REFERENCES

[1] Tsalidis, S., S., Dentsoras, A., J., "Application of design parameters space search for belt conveyor design" Journal of Plant Science Vol. 10, No. 6, pp. 617-629, 2010.

[2]. Huang, T, Wang, P.F., Mei, J.P., Zhao, X.M.,"Time Minimum Trajectory Planning of a 2-DO Translational Parallel Robot for Pick-and-place Operations"IEEE Computer Magazine,Vol. 56, No. 10, pp. 365-368, 2007.

[3] Sahu, S., Lenka, P.; Kumari, S.; Sahu, K.B.; Mallick, B.; "Design a color sensor: Application to robot handling radiation work", Industrial. Engineering, Vol. 11, No. 3, pp. 77-78, 2010.

[4]. Khojastehnazhand, M., Omid, M., and Tabatabaeefar, A., "Development of a lemon sorting system based on color and size" Journal of Plant Science, Vol. 4, No. 4, pp. 122-127, 2010.

[5]. Dogan Ibrahim" Microcontroller Based Applied Digital Control", International Journal of Science, Vol. 23, No. 5, pp.1000- 1010,2007.