## 1.2.1 Indroduction

### A. Microcontroller



The ATmega328 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the Atmega 328 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed. The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU),allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers. The Atmega 328 provides the following features: 4K/8Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 256/512/512/1Kbytes EEPROM, 512/1K/1K/2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes,internal and external interrupts, a serial programmable USART, a byte-oriented 2-wire Serial Interface, an SPI serial port, a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable Watchdog Timer with internal Oscillator, and five software selectable power saving modes. This allows very fast start-up combined with low power consumption.The 16 MHz Crystal Oscillator module is designed to handle off-chip crystals that have a frequency of 16 MHz. The crystal oscillator output is fed to the System. As an alternative to using a crystal, you can use an externally generated 16 MHz clock source as input tothe on-chip 16 MHz oscillator.\_

B. Camera

The camera used in this case will be overhead camera, it will take the snapshot of the object forcolour sensing purpuse. The image captured by the camera will be processed by image processing using

matlab.

The camera used in this case is Logitech PN 960-

000748 whose technical specifications are:

• Video calling (640 x 480 pixels)

• Video capture: Up to 1024 x 768 pixels

• Fluid Crystal Technology

• Photos: Up to 1.3 megapixels (software enhanced)

• Built-in mic with noise reduction

• Hi-Speed USB 2.0 certified (recommended)

• Universal clip fits laptops, LCD or CRT monitors

C. Matlab and Image Processing

The name MATLAB stands for Matrix Laboratory. MATLAB was written originally to provide easyaccess to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects. MATLAB is a highperformance language for technical computing. It integrates computation, visualization, and programming environment. Furthermore, MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in

editing and debugging tools, and supports objectoriented programming. These factors make MATLAB an excellent tool for teaching and research. MATLAB has many advantages compared to conventional computer languages (e.g., FORTRAN)

for solving technical problems. MATLAB is an interactive system whose basic data element is anarray that does not require dimensioning. It has powerful built-in routines that enable a very wide variety of computations. It also has easy to use

graphics commands that make the visualization of results immediately available. Applications are collected in packages referred to as toolbox. There are tool boxes for signal processing, symbolic computation, control theory, simulation, optimization, and several otherof applied science and engineering [17]. Image can be assumed as the visualization of

what vision senses that is captured by camera. Image is considered as a two dimensional function with variables that represent the spatial coordinate. It holds information about color as well as shapes. In color image, RGB color model mixes those three prime color components, red, green and blue, to produce another color. Image capturing and processing have been used widely in diverse applications, such in medical and surveillance applications.

D. Arduino

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple Automation Of Object Sorting System Using Pick & Place Robotic Arm & Image Processing Proceedings of 3rd IRAJ International Conference, 5th January 2014, Mumbai, India. ISBN: 978-93-82702-51-158 microcontroller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors,and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be standalone, or they can be communicating with software

running on your computer (e.g. Flash, Processing, MaxMSP.) The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free. The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment. An Arduino board consists of an 8-bit Atmel AVR microcontroller with complementary components to facilitate programming and incorporation into other circuits. An important aspect of the Arduino is the standard way that connectors are exposed, allowing

the CPU board to be connected to a variety of interchangeable add-on modules (known as shields). Most boards include a 5 volt linear regulator and a 16 MHz crystal oscillator. The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. There are many other microcontrollers and microcontroller platforms available for physical

computing. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

 Inexpensive -The least expensive version of the Arduino module can be assembled by hand.

 Cross-platform - The Arduino software runs on Windows, Macintosh OSX, and Linux

operating systems.

 Simple, clear programming.

 Open source and extensible software- The Arduino software is published as open source tools, available for extension by

experienced programmer.

 Open source and extensible hardware - The Arduino is based on Atmel's ATMEGA8 and ATMEGA168 microcontrollers. There are a great many Arduino-compatible and Arduino-derived boards.

Fig. 3 Arduino Kit

Some are functionally equivalent to an Arduino and may be used interchangeably. Many are the basic Arduino with the addition of commonplace output drivers, often for use in school-level education to simplify the construction of buggies and small robots. Others are electrically equivalent but change the form factor, sometimes permitting the continued use of

Shields, sometimes not. Some variants even use completely different processors, with varying levels

of compatibility.

Servos are DC motors with built in gearing and feedback control loop circuitry. And no motor drivers required. A servomotor is a rotary actuator that allows for precise control of angular position. They consist of a motor coupled to a sensor for position feedback, through a reduction gearbox. They also require a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are used in applications

such as robotics, CNC machinery or automated manufacturing. The servo motor has some control circuits and a potentiometer (a variable resistor) that is connected to the output shaft. This pot allows the control circuitry to monitor the current angle of the servo motor. If the shaft is at the correct angle, then the motor shuts off. If the circuit finds that the angle is not correct, it will turn the motor the correct direction until the angle is correct. The output shaft of

the servo is capableof traveling somewhere around 180 degrees.Usually, its somewhere in the 210 degree

Automation Of Object Sorting System Using Pick & Place Robotic Arm & Image Processing Proceedings of 3 rd IRAJ International Conference, 5th January 2014, Mumbai, India. ISBN: 978-93-82702-51-159 range, but it varies by manufacturer. A normal servo is used to control an angular motion of between 0 and 180 degrees.

Table I. Axis Capabilities

A normal servo is mechanically not capable of turning any farther due to a mechanical stop built on to the main output gear. The amount of power applied to the motor is proportional to the distance it needs to travel. So, if the shaft needs to turn a large distance, the motor will run at full speed. If it needs to turn only a small amount, the motor will run at a slower speed [14] [15] [16].

Fig. 4 Four Axis Robot

The motor is paired with some type of encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to

rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops.More sophisticated servomotors measure both the position and also the speed of the output shaft. They may also control the speed of their motor, rather than always running at full speed. Both

of these enhancements, usually in combination with a PID control algorithm, allow the servomotor to be brought to its commanded position more quickly and more precisely, with less overshooting. The servo turn rate, or transit time, is used for determining servo rotational velocity. This is the amount of time it takes for the servo to move a set amount, usually 60 degrees. For example, suppose you have a servo with a transit time of 0.17sec/60 degrees at no load, this

means it would take nearly half a second to rotate an entire 180 degrees.

Fig.5 Servomotor Rotation

G. Conveyor Belt

The conveyor motor receives power from battery. 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. Conveyor frames are supplied with either butting plate (standard) or hook and bar attachments to secure

each segment together. Heavy duty rollers are supplied with shafts.

Fig. 5Conveyor Belt

III. Result

We can assume objects in circular, rectangular shape in different colours so the result is Table II. Result CONCLUSION Fully functional sorter machine can be implementedby using a structure of parallel and independent channels in order to increase the overall throughput which results with a forecasted performance. The project can work successfully. There are two main steps in sensing part, objects detection and recognition. The system can successfully perform handling station task, namely pick and place mechanism with help of sensor. Thus a cost effective Mechatronics system can be designed using the simplest concepts and efficient result can be observed.

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