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Automatic Material Separating Conveyor

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Abstract
With the recent advancements in industrial technologies, automation has become indispensable part in the manufacturing world. The industrial environments are adopting more and more aspects of automation to enhance product quality, accuracy and to reduce product cost. Conveyor systems are wildly using in manufacturing industries. This automatic conveyor system works by detecting the size of material in the conveyor using ultrasonic sensor and microcontroller analyzes this data - depending upon the height of materials, the servo motor guides the material to three different directions, height-wise. The status of conveyor is indicated by 16X2 Liquid Cristal Display and LEDs. This research thus implement the automatic material separating conveyor to improve the efficiency.

***Keywords*:** Microcontroller, servomotor, ultrasonic sensor, LCD

1. Introduction

Most of the industries have at least one conveyor system to move or to separate the materials. The need to produce an automatic material separating conveyor is essential. Earlier many critics argued that automatic material separating system leads to failure, but due to the advancement of technology, reliable automatic system can be produced. Manual material separation system require more money, time and machines. It will lead to high cost. To reduce these wastage, many companies started to adopt automation in the plant. If the industries use automation, it helps to increase rate of production, with smart utilization of space at lesser / reasonable rates. This automatic material removing conveyor system separate the material depending on their height. It contains a micro controller, ultrasonic sensor, servo motors, liquid crystal display and LEDs. The automation system is able to display which size-box would be receiving the material. The LED display will help to understand the status of material movement. Overall, the system helps to ease movement and add more visibility.

2. System Development / Methodology

The fig.1 shows the flow diagram of system and fig.2 shows the schematic diagram. The basic theme of this project is material flowing through the conveyor, sensed, analyzed, sorted and indicated depending on the height of the material. For this, ultrasonic sensor used as the sensing device. Ultrasonic sensor detects the height of material by capturing reflected sonic wave which transmitted by the same device. At the same time, the timer calculates the time – ultrasonic wave travelling time in the air. The height of the material calculated by these values. The detected distance analyzed by Microcontroller. Microcontroller actuate the servo motor by giving controlled signal. Simultaneously, the microcontroller send the data to the Liquid Crystal display to display and it give power to LEDs to indicate the material movement status.

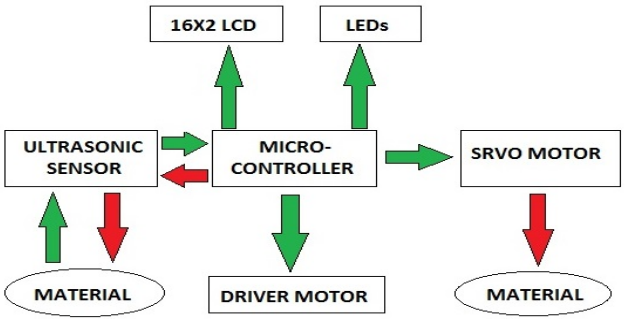

Fig.1 Flow Chart

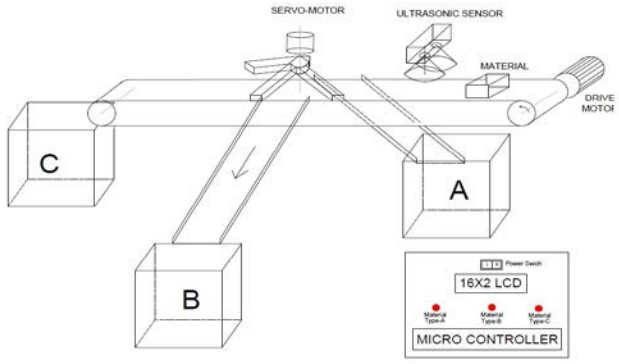

Fig.2 Schematic diagram

2.1 Microcontroller

The Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal

oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega 2560 board is compatible with most shields designed for the Uno.

The Arduino Mega can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack.. Leads from a battery can be inserted in the Ground and V in pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The Mega2560 differs from all preceding boards in that it does not use the FTDI USB-to serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

Fig.3 Arduino Mega2560

2.2 Ultrasonic sensor

Ultrasonic transmitter emits an ultrasonic wave in one direction, and starts to time when it is emitted. Ultrasonic waves spread in the air, and would return immediately when it encounters obstacles on its way. At last, the ultrasonic receiver would stop to time when it receives the reflected wave. As Ultrasonic spread velocity is 340m / s in the air, based on the timer record **t**, we can calculate the distance (s) between the obstacle and transmitter, namely: s = 340t / 2, which is so- called time difference distance measurement principle The principle of ultrasonic distance measurement used the already-known air spreading velocity, measuring the time from launch to reflection when it encountered obstacle, and then calculate the distance between the transmitter and the obstacle according to the time and the velocity. Thus, the principle of ultrasonic distance measurement is the same with radar. Distance Measurement formula is expressed as: L = C X T In the formula, L is the measured distance, and C is the ultrasonic wave spreading velocity in air, also, T represents time (T is half the time value from transmitting to receiving).

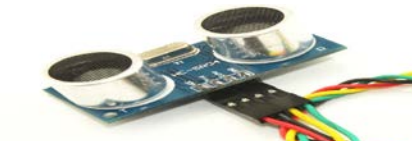

Fig.4 Ultrasonic Sensor

2.3 Servo motor

Servos are DC motors with built-in gearing and feedback control loop circuitry and no motor drivers are required. A servomotor is a rotary actuator that allows 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 capable of revolving approximately 180 degrees.

Fig.5 Servo Motor

2.4 Liquid Cristal Display

LCD (Liquid Crystal Display) (Fig 2.4.) screen is an electronic display module and finds 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 and even custom characters (unlike in seven segment), 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.

Fig. 6 Liquid Crystal Display

2.5 The Program

The Arduino Integrated Development Environment or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

2.5 The Display Panel

The display panel contains liquid Crystal Display (LCD), main switch, three LEDs to give data and indications. The Fig.7 shows the display panel.

Fig. 7 The Display Panel

3. Conclusion

The automatic material separating conveyor system has been constructed and tested. The automatic material separating system highly useful in quality control system to reject and accept materials/products. The automatic material separating conveyor system will help to separate material accurately. The automatic material separating conveyor system will be cost, time and space saving thus aiding to be beneficial in both the economic and technical aspects.

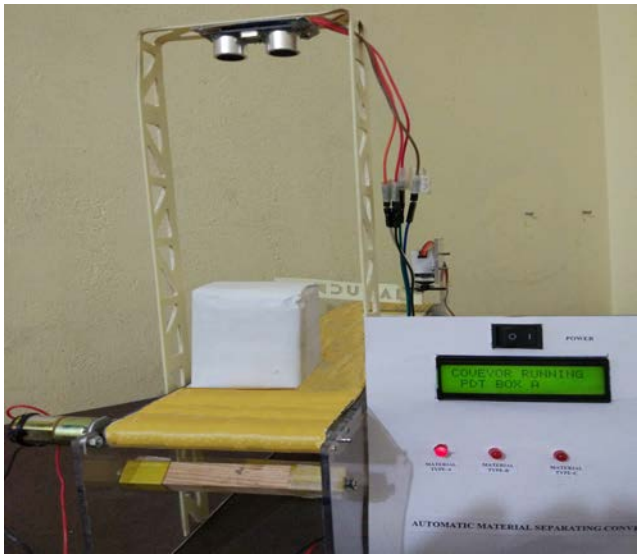

Fig. 8 sample setup

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