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Design and Fabrication of Automatic Sorting Machine using Arduino

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ABSTRACT

This work is based on Design of a transport line conveyor belt for sorting and arranging products based on their height using the IR sensors for detecting the object and mechanism to drive the conveyor belt. The project is locally controlled by the use of Arduino based embedded system. The automatic sorting and arranging machine are used to sort the different types of products based on the product height. This automation significantly reduces the time required for manual sorting in the production line of small/medium scale industries and hence it also decreases the percentage of human error during sorting/arranging. The products are placed on the transport line conveyor system and as it moves on the conveyor it is scanned by the IR sensor, depending on the height of the product these will be sorted into different bins automatically.

Keywords: Automatic Sorting, Sorting Machine, Arduino, Sensor, Engineering and Technology

I. INTRODUCTION

In the present world, there are a lot of logical advancements in the field of manufacturing. Advanced innovations that have improved human life have significantly increased the living standards. Engineers are occupied with the innovative work. Step by step, year by year researchers have come up with better thoughts that have made processes more mechanized. As an endeavour to build up a computerized set-up in whatever region conceivable which would additionally streamline human life and make it simpler, we wound up with the extremely relevant region of concern - sorting.

In different spots where arranging becomes possibly the most important factor transcendently are air terminals, seaports, little scale enterprises, general stores, and so on. However, because of the limited reach of mechanization in arranging in these parts, the idea about computerized arranging in such fields should be considered with a lot of significance. Along these lines, to expand the benefits of computerized arranging in largescale areas to the previously mentioned division, an idea of automation has been thought to execute in little scale divisions.

II. METHODS AND MATERIAL

A. Methodology

The parts which are going to be used in these projects are 3D modelled and drafted on the CATIA V5 software according to the dimensions. This gives us the overview of how the model will look after assembling all the components by using selected dimensions.

The conveyor used in this project needs to smoothly transport products from one place to the other and hence paper belt is used which can easily carry out this operation. For sensing the product moving on conveyor, IR sensors are used as they require very low power, there is no need of contact for detection, they are not affected by oxidation or corrosion. Arduino is used for local control as they are user friendly and are easily programmable. Firstly, the conveyor framework is fabricated along with the assembly of motor and belt. The IR sensor which is used to sense is connected to the Arduino platform.
After collection of resources, geometric 3D modelling of the project and assembling of the parts, the prototype of model is developed. The programming required for sensing the object with the help of IR sensors is needed to be installed into the Arduino UNO microcontroller along with the programme using the Arduino Platform software. After complete programming, the correct connections between the IR sensor, Arduino are made.

The prototype will be run in the required conditions and will be tested accordingly.

B. Components Used

- DC Motor
- Conveyor Belt
- Arduino Uno Microcontroller
- Infra-Red Sensor
- Servo Motor

1. DC Motor

DC motor working depends on the principle that when a current carrying conductor is set in a magnetic field, the conductor encounters a mechanical force. The direction is given by Fleming's left-hand rule. It converts electrical energy into mechanical energy.

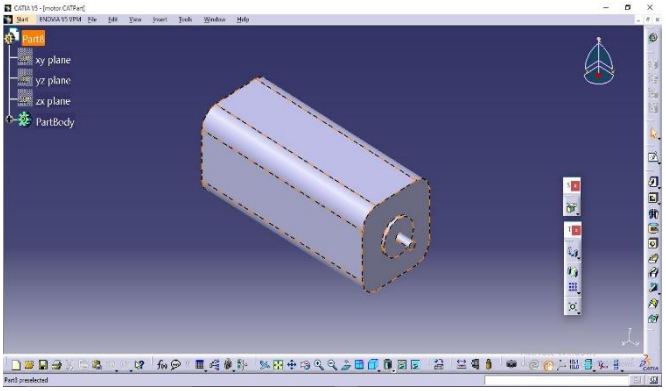

Fig 2.1 DC Motor

2. Conveyor Belt

Conveyor Belts are actually wide belts connected in a loop to at least two turning rotors driven by engines. As a rotor turns, the conveyor belt will also turn because of the strong friction between the rotor wheel and belt. This turning movement of the rotor makes one side of the belt move one way, while different moves the other way. The material to be shipped is kept on belt and it moves alongside the belt to required position. Belt conveyor frameworks comprise of at least two pulleys. The controlled pulley is called drive pulley, the unpowered one is known as idler pulley. A Conveyor belt is a single driven pulley. Thin paper sheet and particular length is used depending on the product size and weight so that is does not affect the conveyor belt rotation.

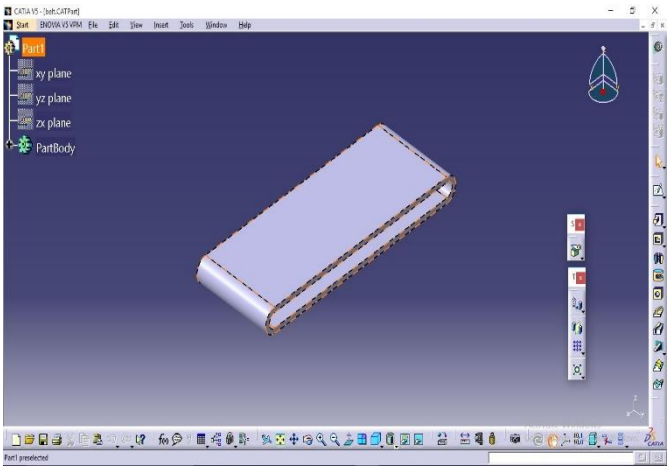

Fig 2.2 Conveyor Belt

III. Arduino Uno Microcontroller

Arduino Uno type is utilized in this project. The Arduino Uno is an open source microcontroller board dependent on the microchip ATmega328P microcontroller. The board is available with sets of digital and analogue input/output pins that might be interfaced to different expansion boards and different circuits. It has 14 digital input/output pins in which 6 can be utilized as Pulse Width Modulation (PWM) yields, a 16 MHz ceramic resonator, an ICSP (In Circuit Serial Programming) header, a USB association, 6 analog inputs, a power jack and a reset button. A software is installed and a programming is saved in Arduino which works and sense the environment and gives required output based on connections. Arduino is being used in this project as it is very easy to handle, flexible, inexpensive and therefore it is connected to IR sensor.

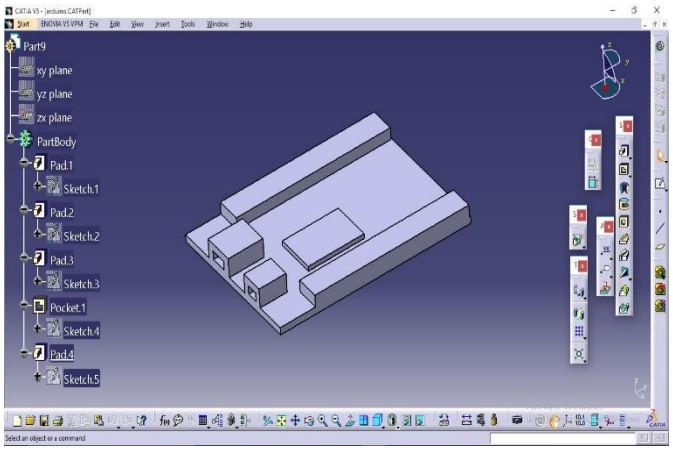

Fig 2.3 Arduino

3. Infra-Red Sensor

An infrared sensor is an electronic gadget, that emits so as to detect a few parts of the environment. An IR sensor can gauge the warmth of an object as well as detects the motion. These sorts of sensors measure just infrared radiation, as opposed to transmitting it that is called as a passive IR sensor. For the most part in the infrared range, all the objects radiate some type of warm radiations. These sorts of radiations are imperceptible to our eyes, that can be identified by an infrared sensor. The emitter is just an IR LED (Light Emitting Diode) and the detector is basically an IR photodiode which is delicate to IR light of a similar wavelength as that discharged by the IR LED. At the point when IR light falls on the photodiode, the resistance and these o/p voltages, change in relation to the size of the IR light. IR sensor is used in this project to sense the product moving on conveyor belt and send signal to Arduino. They require very low power, there is no need of contact for detection, they are not affected by oxidation or corrosion. IR sensor is used in this project by considering all these advantages.

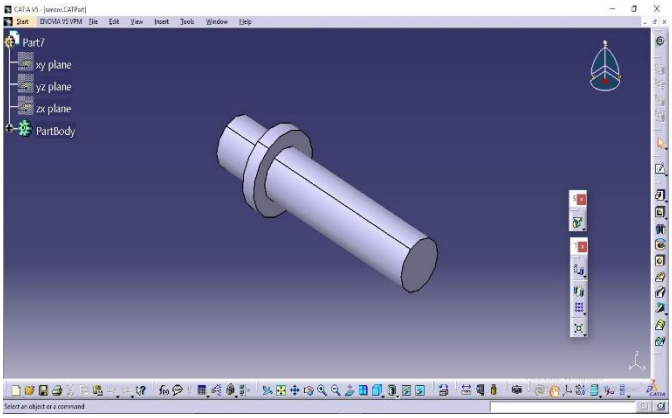

Fig 2.4 IR sensor

4. Servo Motor

Servo motor works at the PWM (Pulse Width Modulation) guideline, which implies its point of turn is constrained by the term of pulse applied to its control PIN. Fundamentally servo motor is comprised of DC engine which is constrained by a variable resistor (potentiometer) and a few riggings. Servo motor controls position and speed decisively. Presently a potentiometer can detect the mechanical position of the shaft. Subsequently it couples with the engine shaft through riggings. The current position of the shaft is changed over into electrical signal by potentiometer and is contrasted and the order input signal. In present day servo engines, electronic encoders or sensors sense the position of the shaft. We provide order input as per the position of shaft. On the off chance that the criticism signal varies from the given information, a blunder signal cautions the client. We intensify this mistake flag and apply as the

contribution to the engine, subsequently the engine pivots. What's more, when the pole compasses to the require position, blunder signal become zero, and thus the engine stays stop holding the position. The order input is in type of electrical heartbeats. As the genuine contribution to the engine is the contrast between input signal (current position) and required sign, henceforth speed of the engine is corresponding to the distinction between the present position and required position. The measure of intensity require by the engine is corresponding to the separation it needs to travel.

C. Working

The products with suitable height when passes the IR sensor triggers and reflects its emitted infrared beam which is received by the receiver of the IR sensor and hence the IR sensor detects the product. This signal is sent directly to the Arduino Uno microcontroller which reads the inputs of the sensor and convert it into output data which activates the servo motor of the guiding mechanism. The Arduino Uno is programmed to power the servo motor for a particular time interval and rotate it to a certain angle which in turn rotates the guiding plate. Thus, the product of more height will strike the guiding plate and will follow its path to the different bin. Hence the sorting of products based on height is accomplished using the guiding mechanism.

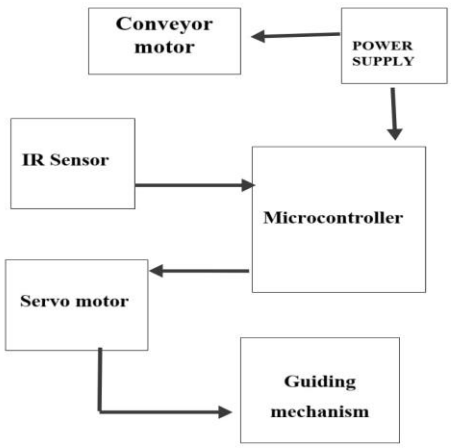

Fig 2.5 Working Block Diagram

IV. GEOMETRIC MODELLING

Using the Dassault System's Catia V5 modelling software, we 3D modelled the parts and assembled it to generate a 3D prototype of the required model.

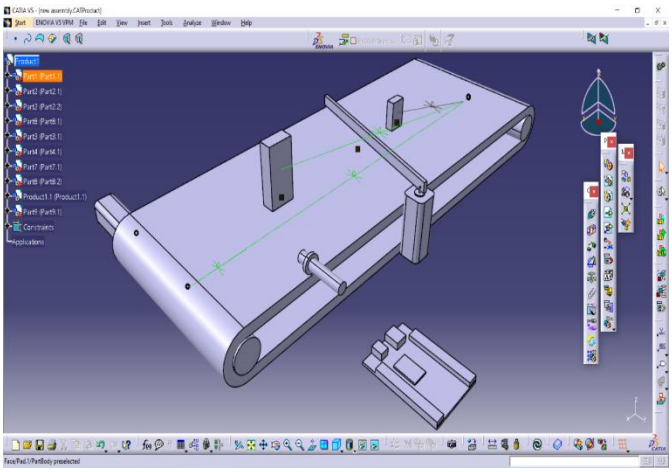

Fig 3.1 3D Prototype Assembly

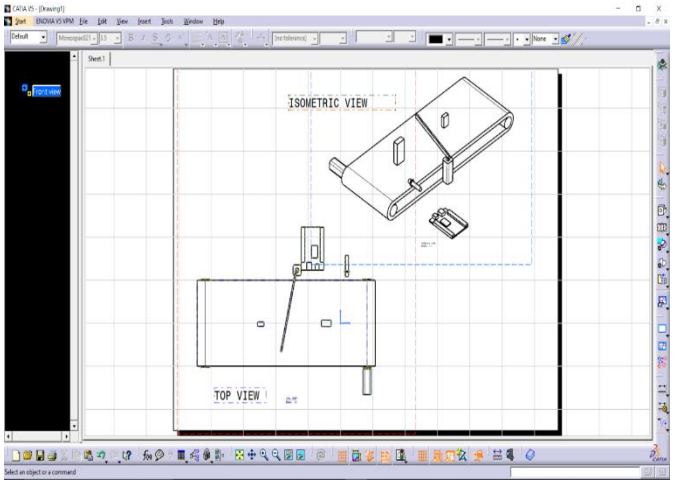

Fig 3.2 3D Prototype Drafting

V. CONCLUSION

Automation in the field of transport line conveyor is of such importance now-a-days that it is impossible to imagine a world of transport without automation. In addition to explaining the basic concepts of automation of transport and sorting, this project links these two with the help of hardware and software and shows how this can be simply managed through microcontrollers and other components. Therefore, this system can be implemented using Arduino platform. Besides these the project also has some disadvantages that using the Arduino platform it can power and control small unit which would be suitable only for sorting products in the small-scale industries. The battery is also unreliable sometimes as the power delivered to the motor to drive the transport line conveyor may not be sufficient.

It can be concluded that with correct connection of some simple hardware and software components, it is possible to create an automatic sorting machine, thus increasing the efficiency of sorting, as well as making the process of sorting and arranging of certain number of products considerably simpler.

VI.REFERENCES

We would like to thank these authors for their help in making this project come to life. Without their papers and insight into this field, I would like to believe this project would not come to life. The only way I can thank these authors is by adding them as my reference.

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