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DESIGN AND DEVELOPMENT OF LOW COST CONVEYOR CONTROLLER FOR COIR INDUSTRY

S. Arun[1], A. Arunkarthick[2], P. Kavinithees[3],
Assistant professor / EEE, P.A. College of Engineering and technology, Pollachi, Tamilnadu, India[1]
UG student, EEE, P.A. College of Engineering and technology, Pollachi, Tamilnadu, India[2,3]
arunselvarajphd@gmail.com[1], aarunkarthick6@gmail.com[2]

ABSTRACT

This research paper emphasizes on the design and real-time implementation of low cost conveyor controller for coir industry. The purpose of this controller was designed to control the machine in the period of over flow of pith in the funnel and avoiding the chattering condition from loaded period, the control unit gets the obstructions signal from LDR and deactivates the motor from supply, the controller also eliminates the chattering effect on start-up period and loaded period of coir pith and regulates motor signals. The entire system is designed as single unit to meet the requirements of small scale coir pith industry consumers, the real-time implementation of conveyor controller unit in coir pith industry gives good results under the overflow of pith condition and also increases the safety of the automated machine as well as increases human comfort inside the industry. Such applications are such as fire safety in the coir industry, over flow detection, chattering elimination. Hardware implementation includes the LDR sensors connected to the microcontroller and motor, the implementation of this work was carried out with AVR ATMEGA328P micro controller.

Keywords: *Development of Low Cost Controller, Chattering Elimination, Simulation of Immune controller***DESIGN AND**

I.INTRODUCTION

Small scale industrials are playing a major role in indian economic investment, to improve their productivity of all the industrials which moves to an automation, automation is purely based on advanced electronic sensor controller, in order to implement the sensor controller in small scale industry the investment cost of their project will increase, so this will not suitable for small scale industry and also most of small scale industries are not implementing high cost controller, it also developes controller units having a certain problem in coir pith industry and there are over flow of pith load from conveyor belt and chattering effect under running period.

Chen Xu-Hui and Md Lutfar Rahman et all [3] suggested a Fuzzy based PID controller for conveyor machine, Michael E. Wroe and J. A. De Abreu-Garcia et all [7] developed a double conveyor system with the digital controller tuned using Ricatti equation. S. Yilmaz and B. Cakir et all [5] industrialised fuzzy control algorithms by means of PLC instructions to control the conveyor speed, Kriangkrai Charoensuk and Nitisak Numanoy et all [8] developed a package verification without sensor. The load torque variable concept is used for controlling the conveyor, Kamishetty Saideep and Marlapati Revanth et all [9] developed a closed loop speed controller for DC motor with controls the conveyor, Suppachai Howimanporn and Sunphong Thanok [10] have used particle swarm optimization to identify the optimal PID controller gain for speed control of conveyor motor, Wei Li and Zhengduo Pang et all [11] developed auto control system using armourd controller, formerly these actions are done by manpower or with the help of electrical sensors like proximity sensor. These components are does not work properly in dusty environment because coir pith industry will generate more dust during on running period, also proximity sensor leads to chattering effect in machine. This will lead a damage to the conveyor machine and reduce the life span of machine,

In this paper, a detailed LDR based low cost conveyor controller unit is developed for conveyor machine to run a stable operation under over flow of coir pith and It is more reliable when compared to existing control unit.

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I. DEVLOPMENT OF LOW COST CONVEYOR CONTROLLER

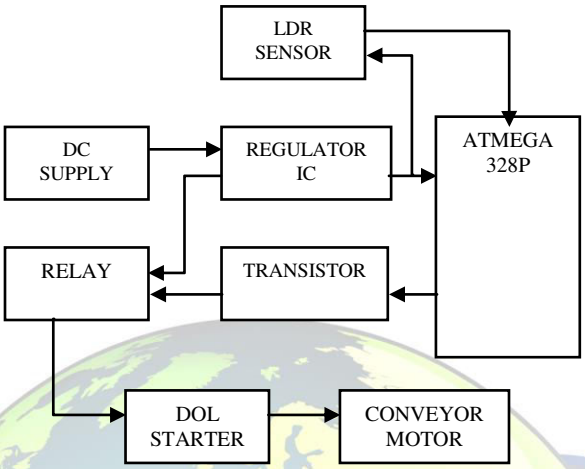

Fig1. Block diagram Of Low Cost Conveyor Controller

The above block diagram is demonstrating the assembly of low cost conveyor controller in coir pith industry, the over flow of coir pith and chattering controlling actions are done by ATMEGA 328P controller with help of switching the transistor and LDR sensing element. The ATMEGA 328P has inbuilt timers so it performs the delay operation in the period of uneven distributed coir load due to this the motor is prevented from chattering effect. ATMEGA 328P receive the overflow signals from LDR and sends the command signal from ATMEGA 328P to relay of the transistor, the relay is operating based on the command signal of ATMEGA 328P, the relay output is connected to DOL starter of conveyor machine.

II. REAL TIME WORKING MODULE OF CONTROLLER IN COIR INDUSTRY

In this model, a LED is placed at the top of the funnel. If the light intensity is low to LDR it refers the level of the load is minimum.

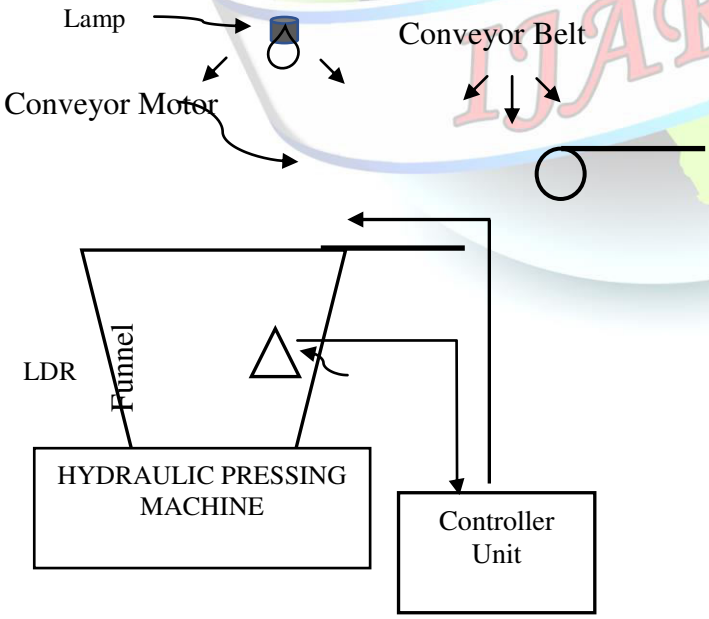

Fig 2. Conveyor Controller setup in coir industry

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If the light intensity is high to the LDR level of the load is increased, hence the LDR will transmit the corresponding signals to the controller in the value resistance. The coir pith is loaded to the funnel through the conveyor belt. The LED light is placed at the top of the funnel for the operation of the LDR. If the coir pith is loaded in the funnel at the above level of LDR the light intensity is very low so the LDR sends the signal to controller unit to turn off the conveyor machine under over loaded condition, so conveyor belt will stop filling the pith in the funnel, After few minutes when the coir load decreases the LDR will gets high intensity and sends the signal to controller unit to turn ON the conveyor machine under unloaded condition, so the conveyor belt is moving according to controller unit during that period, these controlling actions can be done frequently from controller unit, so that the overflow of coir pith will be avoided in the funnel.

The primary controlling action is purely based on LDR operation and the secondary controlling action is to avoid the chattering effect of machine from an uneven distributed load, the chattering effect is affected at the period of loaded and unloaded period of conveyor machine, when conveyor motor is operated at the primary condition the chattering is created at turn ON and turn OFF machine, The controller will turn ON and OFF the conveyor motor through the relay and the relay is operated through the transistor because the relay has ability to pass the reverse current, due to this reverse current damage may occurs to the controller and entire automated part. so the relay is operated through the transistor.

III. CONTROL FLOW OF LOW COST CONVEYOR CONTROLLER

1. LED and controller unit is turned on when the coir pith unit started
2. LDR receive the signals from light intensity
3. If the light Intensity is low or high between LDR to LED, then the LDR signal sends the signal, in term of resistance value to the controller unit.
4. The controller unit sends the command signal to relay through transistor to turn ON and turn OFF motor
5. During turn ON Period, the chattering effect can be eliminated with help of controller because it has an inbuilt timer circuit, the signal also sends the same time period of relay
6. Motor ON and OFF is depended on relay signal, The relay signal is connected to DOL starter.

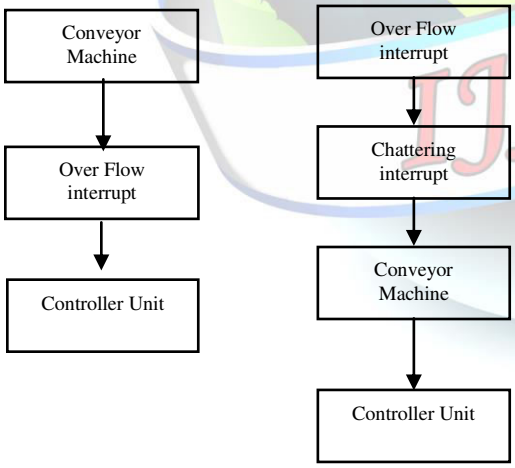

Fig 3. The interruption flow chart

IV. DESIGN ANALYSIS OF LOW COST CONVEYOR CONTROLLER

The design analysis following three parts first one is distance measurement between LED to LDR, in this analysis the LDR has kept inside of the funnel and fixed to above of hydraulic machine and the distance between LED to LDR is

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kept at 1.89m, the light is 9W LED bulb was chosen, second one is calculation of smoothing capacitor to get the smoothness waveform from full wave rectifier and the capacitor value is chosen at $C_{Min} = 450\ \mu F$ from analysis and third one is choosing the resistor value for LM 317, The resistor value is calculated by using the below formula, constant value 1.25 is selected for finding resistance of LM317, the variable voltage regulator equation is

$$V_{Out} = 1.25 * \left(1 + \frac{R_2}{R_1}\right) \quad ----(1)$$

Constant = 1.25

Considered $R_1 = 1000\Omega$

$V_{Out} = 6V$

Hence

$R_2 = 3.8K\Omega$

$I_{adj} = 100\ \mu A$

V. SIMULATION OF IMMUNE CONTROLLER

The immune controller is simulated with help of proteus software, the conveyor motor DOL starter is connected to the relay. From the above parameter analysis the values are substitute to corresponding resistor and capacitor in simulation, if the light intensity is high to LDR then the resistance value is considered as the low load then the relay will get the signal from diode D4 and motor will run under normal condition. if light intensity is low to LDR then the resistance value is considered as the high then the relay will not get the signal from diode D4 and open the terminal from motor to relay, Then the relay will operate through the NPN transistor. Hence to prevent the controller from the fault, the relay is controlled by negative supply, because the transistor cannot operate in high voltage.

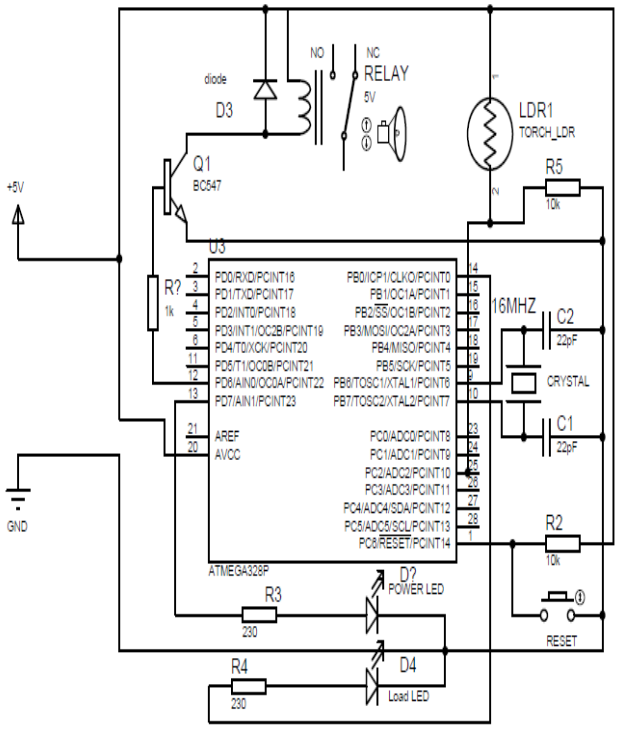

Fig 4. Simulation diagram of Low Cost Conveyor Controller

The relay turns ON when the load is under normal and the relay turns OFF when the load is under over flow. If light intensity value is higher than the LED D4 will turn into red colour. It refers the LED and the relay is turned ON. The light intensity value is lower than the LED will be turn into blue colour. It refers the LED and the relay will be turn OFF.

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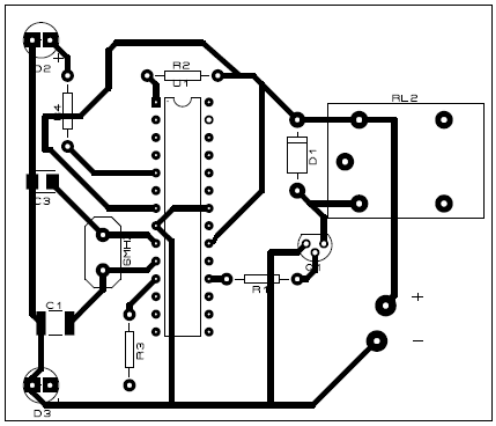

Fig 5. PCB layout of Low Cost Conveyor Controller

The above diagram is representing PCB design of controller unit, simulation results shown in below, the output characteristics is clearly shown that when the light intensity is started to increase diode gets forward biased and relay turned ON, when light intensity is initiated to reduce simultaneously the diode will go to off state, so the relay get turned off.

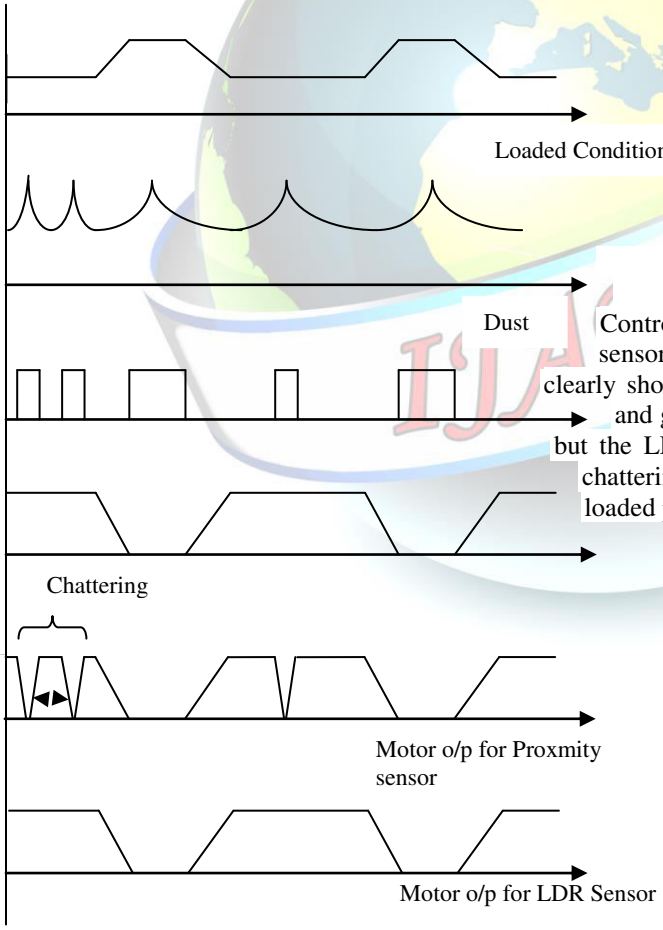

Fig 6. Simulation Results of Immune controller

This simulation results shc ed Proxmity Sensor o/p Controller will give better performance ty sensor controller, the output of simulation characteristics was clearly shown that the coir dust presents more in proximity sensor and generate chattering effect in the machine during operation, but the LDR based controller is not aff LDR Sensor o/p) the chattering is eliminated in inbuilt of controller unit during the loaded period

Fig 7. Experimental setup of Low Cost Conveyor Controller

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VI. CONCLUSION

The successful design of low cost controller unit system for over flow of coir pith in coir industry is controlled under all the operating environment conditions, it will ensure the entire system to run more safely and reliably with high efficiency and economy. since the LDR and ATMEGA 328P is very low cost compare to other sensors and it can be operated even in dusty environment, also the chattering effect is eliminated by providing a time delay in ATMEGA 328P whenever the conveyor machine is loaded, the overall maintenance of this controller unit is very less and more efficient compared to the existing controller unit, this controller is not only suitable for coir industries the conveyor machine also extend to some small-scale textiles industries.

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BIOGRAPHY

B. **Arun Selvaraj** received his B.E in Electrical and Electronics Engineering from Sri Ramakrishna Institute of Technology, Coimbatore, in 2007 and M.E degree in Power Electronics and Drives from Anna University, Coimbatore, in 2010.He is currently pursuing his Ph.D from Anna University, Chennai. He is currently working as Assistant Professor in the department of Electrical and Electronics Engineering at P.A. College of Engineering and Technology, Pollachi, Coimbatore. His research interests are in the field of control system, Electric drives and control and optimization methodology.