# Automatic Yarn Handling Robot using wireless Communication Module for Industrial Application

**Bhuvaneswari M , Mano K V, Manoj S, Rakesh A, Yuvarajan S**

***Abstract:*** ***Today the technology is advancing in the Internet of things and automation technology. Many small scales industries are yet to be automated because of its high cost for implementation .The yarn material is manually transported by labor in the small scale industries and medium scale industry this will takes more time, labor cost and human effort. To overcome the problem of time and labor the concept of automatic yarn handling robot is planned because of the advantage of work efficiency and offer error free results. The main objective of this paper is to reduce the Manual transportation of yarn by replacing with automatic yarn handling Robot. The Automatic Yarn Handling Robot can be used in industries for continuous yarn Transportation from one process to the other. Robot can deliver the information related to materials, quality and also verify and show the amount of yarn transporting every time. In short monitoring the yarn material is quick and efficient. It is possible to move Robot in industries to the required place by following the lines which can be visible black and white lines or an invisible magnetic line. These lines are detected by Infrared Sensor to move the robot along the path. Since there can be path cut off by some obstacles which interrupts the robots movement. The obstacles can be identified by using the proximity sensor and the buzzer for alert. These devices are controlled using the Peripheral Interface Controller. In this paper, the details of robots design, working and application to industries are discussed in the following sections.***

***Index Terms*****: About four key words or phrases in alphabetical order, separated by commas.***

## I. INTRODUCTION

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## II. COMPONENTS AND PROPERTIES

The design and fabrication of automatic yarn handling robots required many components. They are PIC16F87 controller, Load cell, DC Motors, Sensors, wireless connectivity module, Power supply etc. the detailed information and specification is discussed in the further section.

### A. PIC CONTROLLER

PIC meant for Peripheral Interface Controller .the main function of PIC is for controlling application. Peripheral Interface Controller is a powerful controller as it has 200 nanosecond instruction executions but it is also easy to program since it has only 35 single word instructions. PIC16F877 microcontroller has the following functional specification. It has 2 pulse width modulator with 256 Bytes EEPROM data memory and 14KB Program Memory [2]. PIC programming is easy to understand and write in Embedded C language. It has 40 pins with a CPU speed of 5MIPS and its Operating Voltage Range is between 2V to 5.5V.

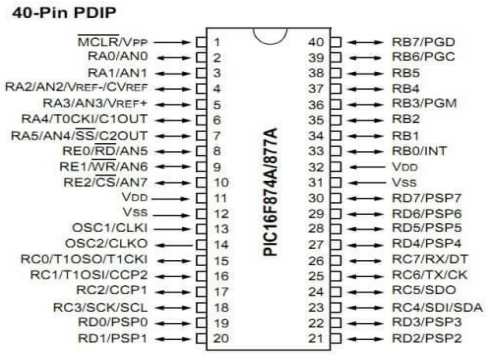


**Fig 1 Pin diagram**

### B. LOAD CELL

A load cell is a transducer which creates the electrical signal. The magnitude generated is directly proportional to the force which is applied on load cell. There are various types of load cell like Hydraulic, Pneumatic, Piezoelectric and Strain gauge. Load cell is used to measure the weight of the object which is placed over the load cell.

The load cell is interfaced with PIC microcontroller using HX711 load cell amplifier module. It has 24 bit analog to digital converter which is designed for weight scales. The analog signal which is produced by load cell sensor is passed to the load cell amplifier module and it converts the analog signal into digital signal.

Fig 2 Double bending beam Load cell

### C. DC MOTOR

DC motor is an electrical device which converts electrical energy into mechanical energy. There are two types of DC motors and they are Brushed and Brushless DC motors. Based on the type of current flow motor is divided into two namely AC and DC motors. DC motors movement is based on the concept of electromagnetism. In this we used 10rpm 12v DC motor with a gearbox. At no load condition it requires 60mA and at load condition it requires 300mA maximum current [3]. It produces the torque of about 12kgcm.It has a shaft of 10mm diameter with an internal hole.

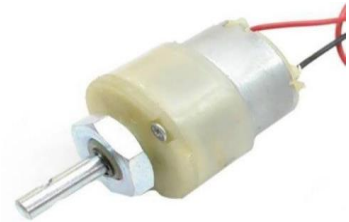

Fig 3 DC Motor

### D. SENSORS

Sensors are used to record the physical phenomenon and it converts the physical phenomenon into an electrical signal. In this we have used Ultrasonic sensor and Infrared sensor. In default, Ultrasonic sensors are used for range detection purposes like sonar, radar etc. In this we have used Ultrasonic sensor for obstacle detection in the path of the robot. This sensor helps the robot to avoid the obstacles. There is a transmitter and a receiver in the senor which is used sends and receives the ultrasonic waves [4].

Fig 4 Ultrasonic SensorHC-SR04

Infrared sensor is a sensor in which there is a transmitter and receiver which sends and receive the Infrared waves. Here the Infrared sensor is used to follow the path of the robot. The path can be of black and white lines or it can be of magnetic lines. Infrared sensor acts as an eye to the robot as it follows the path of lines.

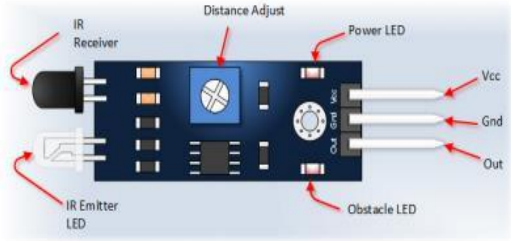


Fig 5 Infrared Sensor

### E. WIRELESS CONNECTIVITY

Wireless communication is the transfer of information from one source to another and vice versa. Wireless connectivity can be of Wi-Fi and Bluetooth devices. Wi-Fi is a wireless device which covers large area and it can have many devices to connect at a time. Bluetooth is a device which covers the short range without any wired connection. In this robot, Bluetooth is used to control the robot manually using Smartphone [5]. By developing an app for Bluetooth interface we can control the robot. By using this, we can use this robot for any other purposes other than yarn handling.

Fig 6 Bluetooth Module

### F. BATTERY

Battery is the source which is given to the devices. It is an electrochemical cell which transforms the chemical energy into electrical energy. Battery consists of two terminals namely cathode and anode. The positive terminal is called cathode and negative terminal is called anode. Here we have used the Sealed Lead Acid Rechargeable Battery which has the capacity of 4.5Ah of 6Volt. This battery is rechargeable and recyclable.

## III. DESIGN METHODOLOGY

The chassis of the robot is designed using Solid works and CAD. The above block diagram explains the basic connections of the robot with the input and output. The PIC16f877a microcontroller is the controller for all over the process. The sensors of

Infrared and Ultrasonic sensors are the sensors which produces the input to the controller to run the motor which drives the wheel of the robot over the path. The Infrared sensor is used to move the robot over the black and white lines or over the magnetic lines. Magnetic lines are invisible lines. The Ultrasonic sensor is used to detect the obstacles in the path of the robot. If there is a obstacle in the path of the robot, sensor detects the obstacle and it alerts the surroundings by buzzer sound. The load cell is the input device which measures the weight of the yarn that is loaded over the robot for transmission to next process. This is processed and the output is given to LCD to display the weight. Battery is the source which is given to all these components. The PIC microcontroller controls overall process since it is the brain of the robot. The

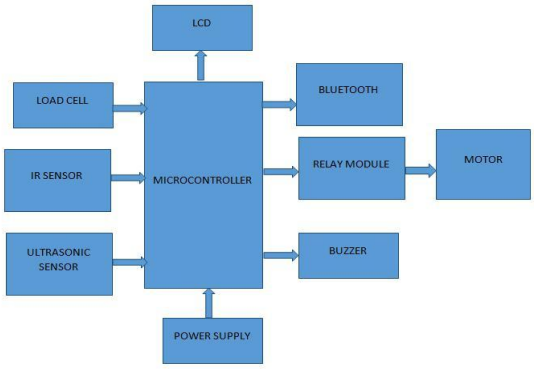


Fig 7 Block Diagram

Bluetooth module is interfaced with PIC microcontroller. It is an interface between PIC and the Smartphone which is used to control the robot manually. The robot is automatically processed by PIC microcontroller with relay module to repeat the process. The robot can also be manually controlled using Smartphone with the Bluetooth module. This is the design and working process of the Automatic Yarn Handling Robot. By using this robot, the efficiency can be increased, by reducing the human effort and it also makes the process simple.

## III. EQUATIONS

a) Efficiency of Motor:

Efficiency of Motor is defined as the ratio of output power to the input power.

$E = Pout / Pin$ (1)

Here Pout is the output power, Pin is the input power.

$Pin = I * V$ (2)

Here I is the current in Ampere, V is voltage in volts.

$Pout = T * W$ (3)

Here T is the Torque of the motor in Newton meter, W is the frequency in rad/sec.

$T = ( I * V * E * 60) / (2\pi * N )$ (4)

Here, E is the Efficiency and N is the Number of revolution in rev/min.

b) Range Detection:

Distance = Time * Speed (5)

Here Distance in meter, Time in second, Speed in meter/second.

## IV. RESULT AND CONCLUSION

The automatic material handling robot will be used in small scale industries for handling the yarn material without human intervention. The actual weight to be carried every time, direction of travel, number of yarn bundles transports are calculated automatically without errors. The implementation of Robot will help to reduce Human intervention. It could be implemented in Medium or large scale industries where long distance and wide range coverage is required. These results in the reduction of labor cost and work efficiency. The production rate can be increased based of the demand from customers. Sim Mechanics can also be incorporated for this purpose[7] . This paper is concluded with the design and fabrication of Automatic yarn handling robot. This work has wider application than Manual material handling technologies as it provide significant details to Automatic material handling than manual material handling technology. By implementing this robot, human effort and production time can be reduced with increase in the production rate. This work can be integrated with mind controlled sensor [6] to control the application in virtual mode.

## V.FUTUREWORK:

This paper provides details related to wireless operation of materials handling techniques using Bluetooth module which is limited to 100 m range. The range can be improved by incorporating Wi Fi module which can be improved further by incorporating many sensors with it and can be used in Internet of Things environment. By using this module more information can be collected, stored and processed effectively. This in turn established effective range of connection for material handling process. Higher level of automatic material handling will be processed in the centralized controller and coordinator nodes can be assigned and monitor the performance of the structure will be done with current work environment.

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