



## IR BASED INDUSTRIAL WALL-E FOR PACKAGE DELIVERY USING COLOR SENSOR

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**Abstract** - Recent trends in automation are characterized by geographical distribution and functional integration. On the technical level, the goal is to easily connect devices and software components from different vendors. Functionally, there is a need for interoperability of control functions on different hierarchical levels ranging from field equipment to process control, operations management and various Internet-based service applications. For an intelligent system to work the commands should be given before hand and it should operate on its own. Once the functions are set, it should complete all the task. Here we are using a robot which will perform some specific task assigned to it. Line follower arrangement will determine the robot path from source to destination. And robotic arm to pick and place objects from one place to other. Also we have given a colors sensor to sense the color of the package and deliver it to the respective destination.

**Keywords**—CC22500, IR sensor, Motor driver, Color sensor, Arduino mega 2560

### I. INTRODUCTION

In the current highly competitive business environment, the industry is challenged by the demand for productivity, quality, safety and environmental protection. Tight profit margins and networked manufacturing emphasize the need for integration and global optimization of production facilities. The role of information technology in achieving these goals has become critical. Large and complex production systems cannot be efficiently and safely managed without advanced information management and process control. End users expect to get improved functionality at reasonable cost. Management of knowledge and real-time information, integration with condition monitoring and plant maintenance, high availability, flexible upgrades and life-cycle support are examples of key requirements. System integrators need efficient tools for building applications. Manufacturers face the challenge of satisfying customers needs while still maintaining a sound and profitable product structure in a rapidly changing technical and business environment.

The word Automation means doing the particular task automatically in a sequence with faster operation rate. This requires the use of microcontroller together with communication network and some relevant software programming. Application of automation in field of industry will revolutionize the manufacturing industry altogether.

Industrial Wall-e uses IR technology which is very basic, and the robot can be built at a very cheap expense. Instead of fixed path, wall-e is designed to use line following technique. It uses IR transmitter to guide the robot when it has reached a path junction. This is why this robot can function in any industry and in any environmental conditions irrespective of the internal industrial structure without changing the program of the robot. It also assures flexibility in sorting the packages according to the color and delivery location.

### II. METHODOLOGY

This project is a smart way of delivering packages within an industry. It can be used in hazardous environments and other hot and cold environment where temperature conditions are not favorable for humans. It can also used in pharmaceutical industries where human presence is prohibited.

It uses multiple IR transmitters and receivers for package delivery. The packages are sorted on basis of the color. The color sensor on the robot detects the color of the package and transports it to the specific departments.

The way guide of the robot is done by line following. Additional IR transmitters indicate the robot if it has reached the destination or the source. The command for alternate action is taken accordingly if it has to pick the package or drop the package. Path guidance is done by additional IR sensors which guide the robot what path it has to choose when it has reached intersections. The overall action will be repeated until the remote control does not specify if to stop the action or not.

When object is determined by the wall-e, the arm of the robot will pick the object and place it to the specified location using color sensor. TCS3200 is the color sensor used, which detects the light reflected by the body. TCS3200 is color light-to-frequency converters that combine configurable silicon photodiodes and a current-to-frequency converter on a single monolithic CMOS integrated circuit.

TCS3200 color sensor reads 8\*8 matrix of photodiodes. All these filters are collect RGB (red, green, blue) data from the source. The data collected from the sensor is converted into a square wave of 50% duty cycle by an oscillator integrated in the chip. This wave is then sent directly to the arduino. Signal transfers to the motor drivers to activate the arm to pick the object and drop it to the place defined by programming. The selection of frequency and color is shown in following Tables 1 & 2. The selection of output frequency is done by terminals S0 and S1, while the color selection task is accomplished by the photodiode output terminals S2 and S3.

**Table 1:** Frequency Selection

S0	S1	Output Frequency Scaling( $f_o$ )
L	H	2%
L	L	Power Down
H	H	100%
H	L	20%

**Table 2:** Color Selection (Photodiode Type)

S2	S3	Photodiode Type
L	H	BLUE
L	L	RED
H	H	GREEN
H	L	Clear(no filter)

### III.FLOW CHART

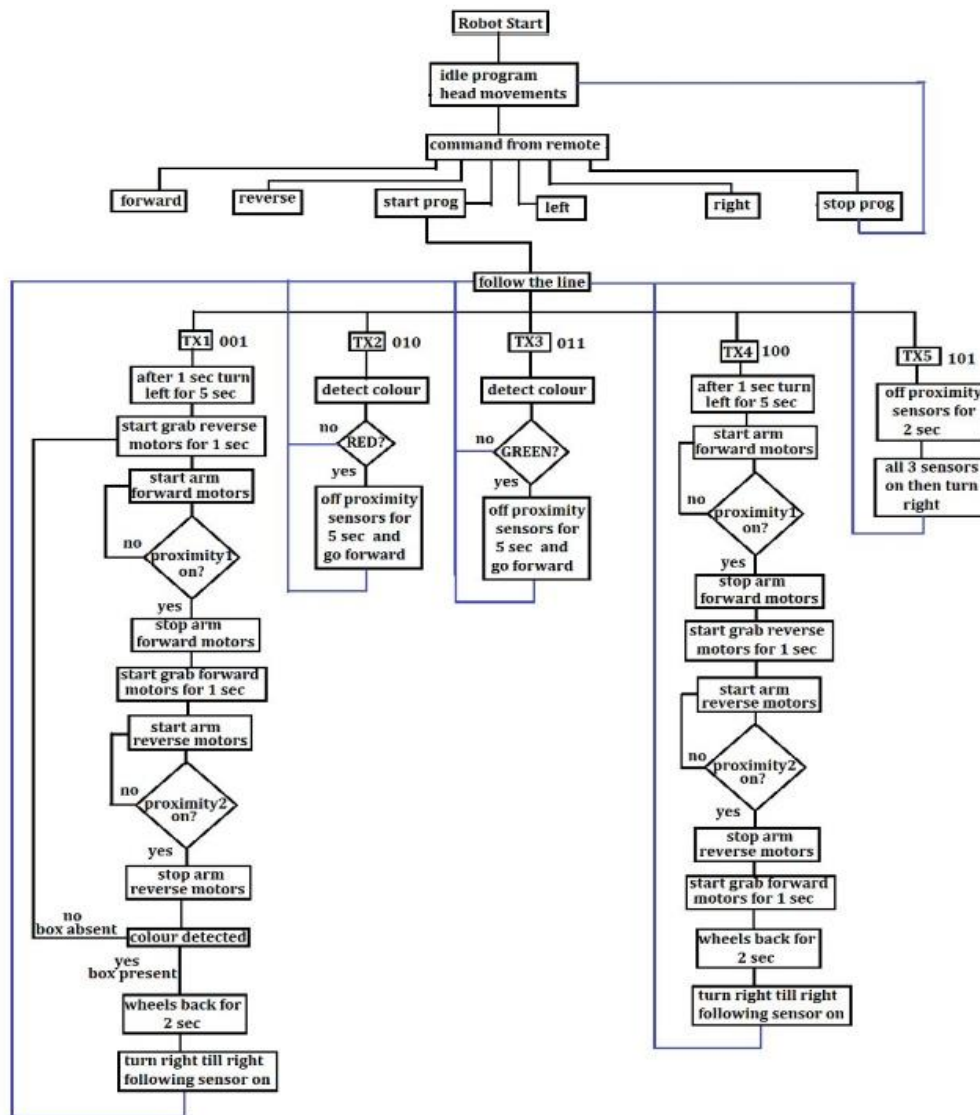


Figure no.1

The robot will be brought to the work place using a remote.

Once the robot is brought to the work place it will start working in the following manner:

- First of all it will start following the line.
- After reaching the package picking spot, it will go straight for 1 sec and turn left. The package picking spot is determined by the on off position of the IR led transmitter placed on the left hand side of the pathway. .
- Now the arm grabbing motion will be initiated which will widen the arm to grab the package. This motors are kept on for 1 sec
- Now arm forward motion will be initiated and will be stopped only when proximity sensor located for arm position detection is on.
- Assuming that the box is present, the robot will grab the box by reversing the grabbing motors for 1 sec. After this arm reverse motors will lift the package and bring it closer to the body of wall-e. This reverse motors will stop when arm back position detection proximity sensor shows high.
- Now color sensor will detect the color. If the color other than which is registered in program i.e red or green is detected which can also indicate no presence of box then the box lifting procedure will be initiated again.
- After lifting the box the robot will initiate wheels backward motion for 2 sec. This will bring the robot behind the main track. Now wheel forward right is started. Now the line following is resumed till another IR transmitter box is detected.
- Take command from Tx2/Tx3 as per the on off status on it.
- Now again follow the main path.
- On reaching Tx4, rotate right and drop the package by first starting the forward arm motion and then forwarding the grabbing motors. After this the arm reversing motion week be initiated and then the grabbing motors will be forwarded.
- After dropping box and arm retrieved, robot will initiate wheels backward motion for 2sec. This will bring the robot behind the main track. Now wheel forward rights kept on till the right proximity detects the main path. Now the line following is resumed till another IR transmitter box is detected.

The command given to robot by various transmitters is as follows:

	Rx1	Rx2	Rx3	Command in Program
	0	0	0	-----
<b>Tx1</b>	0	0	1	If Red go straight for 5 sec
<b>Tx2</b>	0	1	0	If Green go straight for 5 sec
<b>Tx3</b>	0	1	1	Package picking spot arrival
<b>Tx4</b>	1	0	0	Package drop spot arrival
<b>Tx5</b>	1	0	1	Go straight for 2 sec

Table no: 3

## IV.WORKING

### 4.1 ROBOT SIDE

Robot side circuit consists of arduino mega, ir sensor, color sensor, motor driver, wireless module(CC2500) and some other components. The robot uses arduino mega 2560 which consist of 100 pin. The PE1 and PE0 are PWM pins which are connected to the RXD and TXD pins of CC2500 IC .Color sensor TCS 3200 is used. The pins s0 is connected to pe5, s1 is connected to pg5, s2 is connected to pe3, s1 is connected to ph3 and out pin is connected to ph4.

The crystal pins are connected to pins xtal2 at pin 33 and xtal1 pin 34. Reset pin is pin 30. The robot has 3 IR receivers. these are connected to pin pk7 (82), pk6 (83) and pk5 (84). 4 motor driver ic L293D are connected. The motor driver ic as power supply of 5V and 12V. 5V connected to VSS and 12V is connected to VS. Wheel motors , head motor, Arm motor and grabbing motor are connected to motor driver IC at pin 3 and 6 and pin 11 and 14 of respective ic's. The pin 2, pin 7 , pin 10 and pin 15 of motor driver ic 1 are connected to pa1 , pa3, pa5 and pa7 of arduino. The pin 2 and 7 and pin 10 and 15 of motor driver ic 2 are connected to pc6 , pc4, pc2 and pc0 of arduino. The pin 2 and 7 and pin 10 and 15 of motor driver ic 3 are connected to pc1 , pc3, pc5 and pc7 of arduino. The pin 2 and 7 and pin 10 and 15 of motor driver ic 4 are connected to pa6 , pa4 , pa2 and pa0 of arduino. The proximity sensor which are IR transmitter and receiver are used for line following sensor. These sensor are connected to pin pk3 and pk4 of arduino.

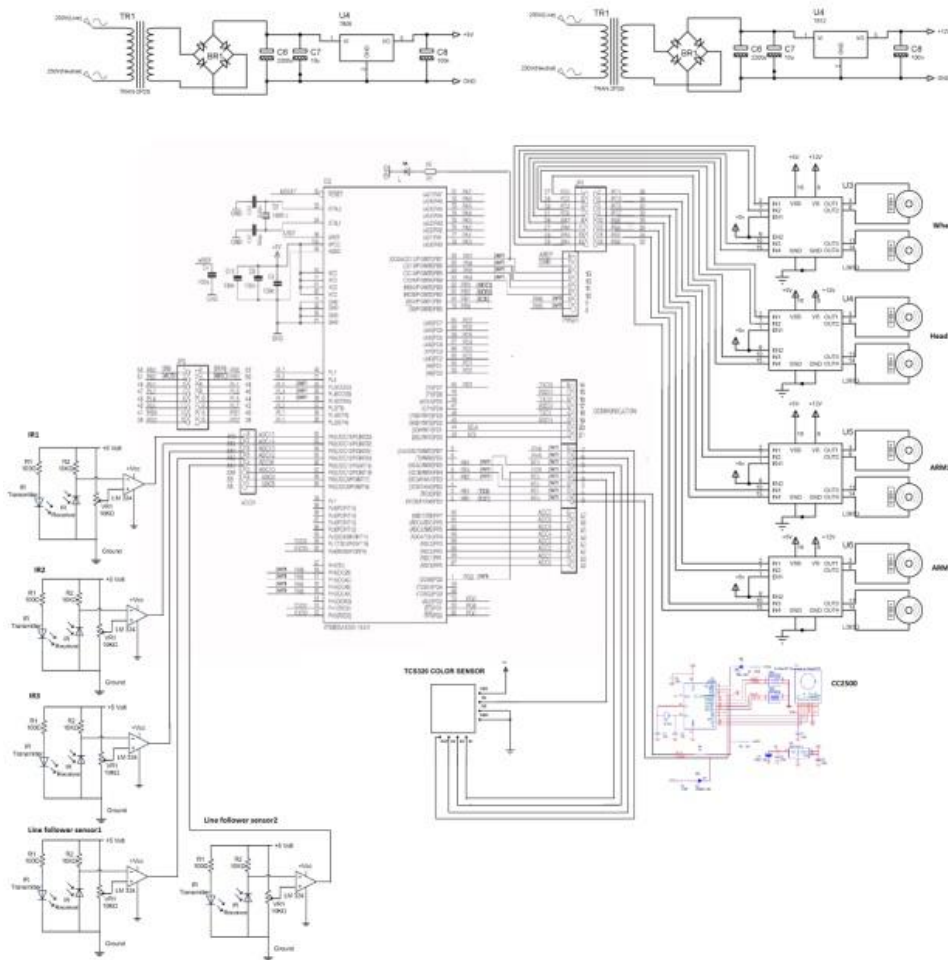


Figure no.2

#### 4.2 REMOTE SIDE

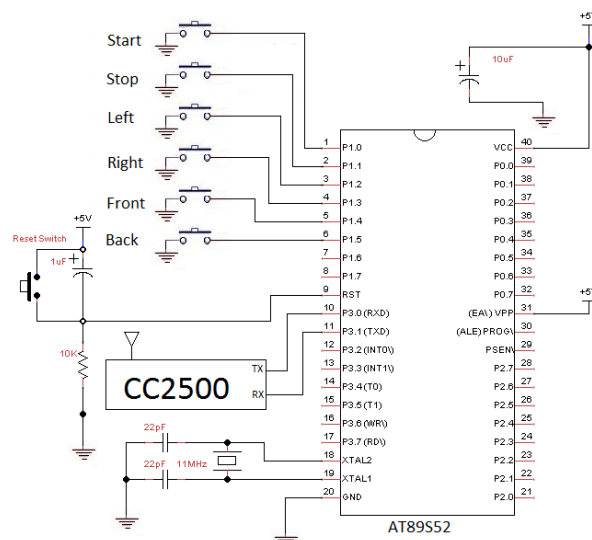


Figure no.3

The remote on the other hand uses microcontroller AT89s52. A six switches are connected to pin 1, pin 2, pin 3, pin 4, pin 5, pin 6 which are pins of port 1. Wireless rf transmitter cc2500 is connected to pin 10 and pin 11. Pin 9 is reset and pin 18 and pin 19 are connected to crystal oscillator.

#### **V.CONCLUSION**

Robots are an important component in Intelligent Environments like Automate devices and provide physical services. Robot Systems in these environments need particular capabilities like Autonomous control systems, Simple and natural human-robot interface, Adaptive and learning capabilities, Robots have to maintain safety during operation. While a number of techniques to address these requirements exist, no functional, satisfactory solutions have yet been developed. Only very simple robots for single tasks in intelligent environments exist.

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