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Object Sorting System Using Wireless Media and Sensor Technology

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Abstract: ***In this paper we have proposed simple, low cost, low power consumption object sorting unit based on its shape where it is placed on conveyor belt which is running continuously with help of low rpm DC geared motors. The objective of the project is to sort the object according to dimension and sends same information to remote PC by using RF ZigBee Our Proposed work aims at testing of the manufactured component by an automated way instead of using the manual means for inspecting the material moving on the conveyor belt of different sizes and can be separated automatically with each other. It is aimed to reduce the human effort and at the same time increase the productivity and accuracy levels that cannot be achieved with manual operations.***

Keywords: ARM, ZigBee, Conveyor belt system, DC geared motor, PC

1. Introduction

In the speed running world everyone are considering the time factor as an important issues. To reduce this time or managing this time, a small implementation which is useful to industries is our project. Today in industries, same model or same object is manufactured with little variation like color, size etc. For placing the same type of object form one place to other place, sorting them on color and size bases we use labour.So for this all industries will spend huge amount as wages and take lot of time for processing. By considering this entire project which make all this i.e.,

1. Sorting of object based on dimension
2. Counting the objects which were sorted and display of its size would be better choice.

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyors are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transportation for a wide variety of materials, which make them very popular in the material handling and packaging industries. Many kinds of conveying systems are available, and are used according to the various needs of different industries. We here are making a conveyor belt based machine that carries goods of different height. The object rejection set up removes the item from the moving belt if it does not fulfil the condition. This machine causes objects or articles to travel along a path wherein the objects are scanned by known types of Infrared electronic sensors which determine the height of material. Downstream of the scanning location there are means actuated by the sensor to eject or divert material from its normal path of travel to a collection station for similar heights of objects.

2. Proposed System

The objective of the proposed work is to design, fabricate and develop a fully automated end of line testing machine. With this objective the proposed work is divided in 3 modules as:

- Concept Designing
- Fabrication and Assembly
- Automation

A. Concept Designing

This phase involves the design of the various elements of the mechanical structure that includes the design of the conveyor belt along with the conveyor rollers, supporting base plate for mounting the motor, worktable on which the entire assembly is mounted. The design has been developed from the point of view of manufacturing feasibility, reliable detection, reducing the rejection rate etc.

The design consists of the following components/elements:

- Microcontroller.
- Conveyor Belt of 130mm length, 30mm width.
- DCGear motor forproviding the required rotation motion to the belt having torquecapacity depending upon the load to be moved/ rotated.
- Supporting plates for the motor and the roller of suitable dimensions.
- The conveyor roller of appropriate length, 50mm diameter and the amount of friction to prevent slipping of the belt on it such that it we have a smooth rotation motion of the conveyor.
- Supporting base for rigidly holding the whole assembly.

B. Fabrication and Assembly

This phase deals with the fabrication and assembly of the individual components. The Conveyor, Conveyor Roller, DC Gear Motor, the supporting plates for the motor and rollers, sensor station and PCB are to be assembled together and properly mounted on the proper base for the worktable with perfect alignment. Various manufacturing

processes like lathe turning operation, metal working & drilling operations have been performed to fabricate.

C. Automation

Start/Stop control of the DC motor for running the belt step upon detection of Components being tested by sensors is achieved through instructions being fed through the microcontroller. The motor is to be interfaced with this controller, so that it can be directed and controlled by the program. DC Motor is controlled by without H bridge circuit, and sorted data is sent via ZigBee to remote PC where it can display object dimensions on COM port window.

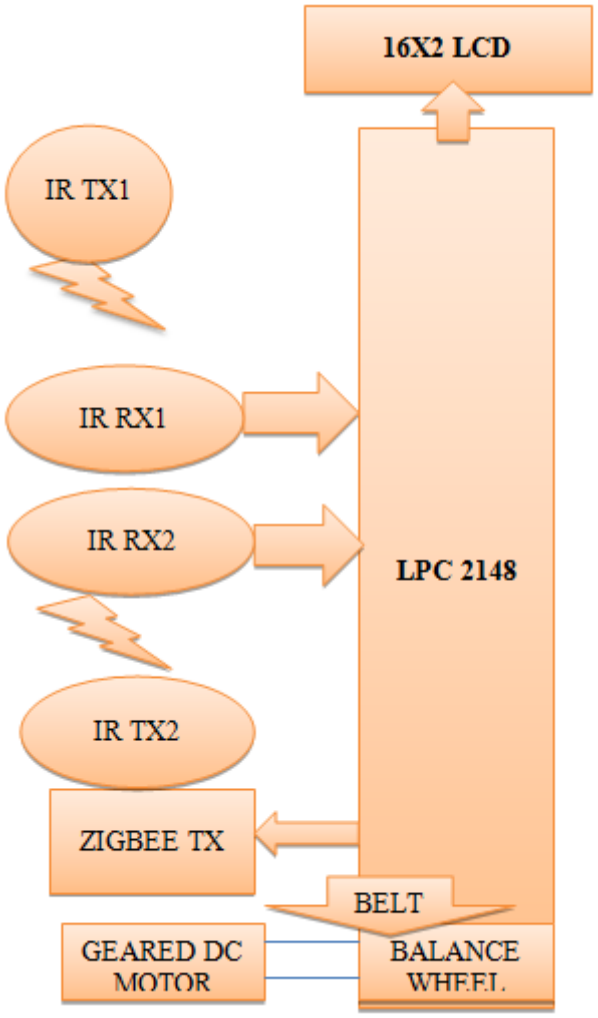

Figure 1: Block diagram of system

D. LPC 2148 Processor

This is a 32-bit ARM7-TDMI-S microcontroller with 32kB of on-chip static RAM and 512 KB of on-chip flash memory. It has 128-bit wide interface/accelerator that enables 60MHz of operation. Also has In-System Programming using on-chip boot loader software, 400ms of full chip erase and 256 B of programming in 1ms. For interfacing of sensors, it has 10-bit ADC with 8 analog inputs and a conversion time as low as 2.44µs per channel. CPU operating voltage is 3V to 3.6V so that the proposed system requires only lower power consumption as the same mentioned before. The Architecture is based on RISC principles and its simplicity yields in a high instruction throughput and real-time interrupt response form a small and cost effective processor core. It also has another architectural strategy such as 16-bit Thumb instruction along with 32-bit ARM instruction set which will enhance the code density in restricted memory conditions while returning most of the ARM's performance.

E. ZIGBEE™ Networks

ZigBee™ networks are basically based on IEEE 802.15.4standard, which specifies the MAC [33, 34] and physical layers for low rate wireless personal area networks (LR-WPAN).

Figure 2 shows the ZigBee™ stack. A low power and large network size is the mainfeature of ZigBee™.
Figure 3 shows the comparison of ZigBee™ network with contemporary wireless technologies like Wi-Fi™ etc.

The XBEE Pro Series1 consists of 20 pins. These are configured accordingly to make them as end devices, router and coordinator.The DIO pins are used for communication without any change in the hardware and are configured using X-CTU software.

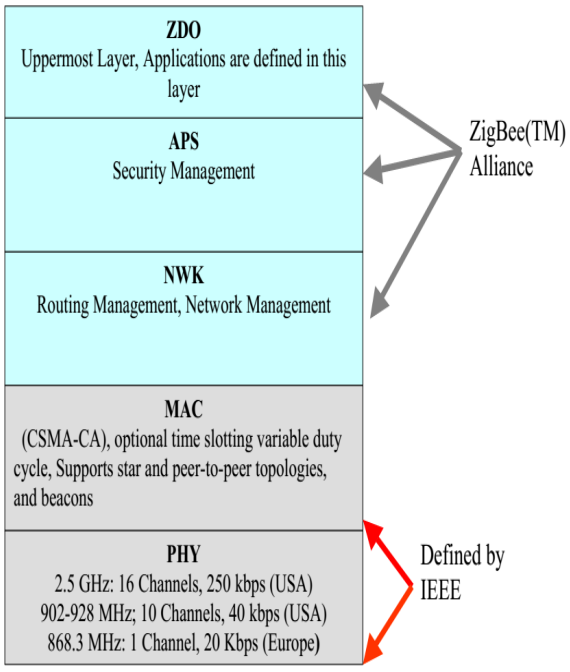

Figure 2: ZigBee(TM) Stack

Market Name Standard	ZigBee™ 802.15.4	GSM/GPRS CDMA/1xRTT	Wi-Fi™ 802.11b	Bluetooth™ 802.15.1
Application Focus	Monitoring and Control	Wide Area Voice and Data	Web, E-mail, Video	Cable Replacement
System Resources	4KB-32KB	16MB+	1MB+	250KB+
Battery Life (days)	100-1000+	1-7	.5-5	1-7
Network Size	Unlimited (2^{64})	1	32	7
Bandwidth (kBps)	20-250	64-128+	11,000+	720
Transmission Range (meters)	1-100+	1000+	1-100	1-10+
Success Matrices	Reliability, Power, Cost	Reach, Quality	Speed, Flexibility	Cost, Convenience

Figure 3: Comparison of ZigBee™ network

The schematic diagram for XBEE Pro series1 is given below in figure 4.

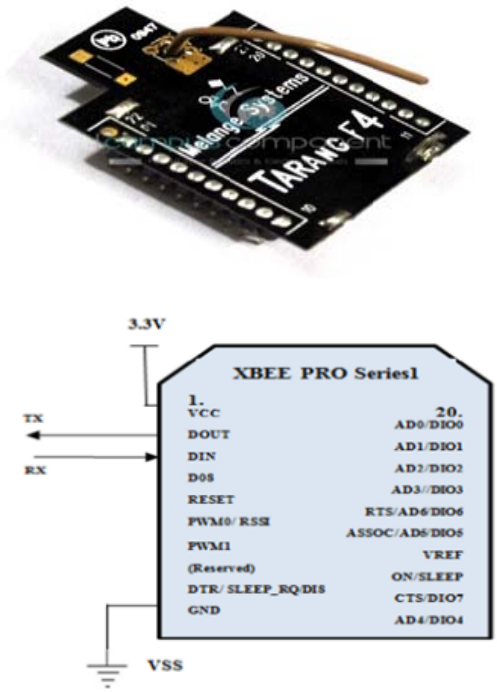

Figure 4: Schematic diagram for XBEE

F. Sensor

IR (Infrared) sensors function is to detect the infrared light; it is transformed to into electric current which is detected by a IR detector. It can sense certain characteristics through its surroundings by emitting or detecting infrared detection since these waves are invisible to human eye due to its wavelengths varies from 0.75 to 13micro meters.

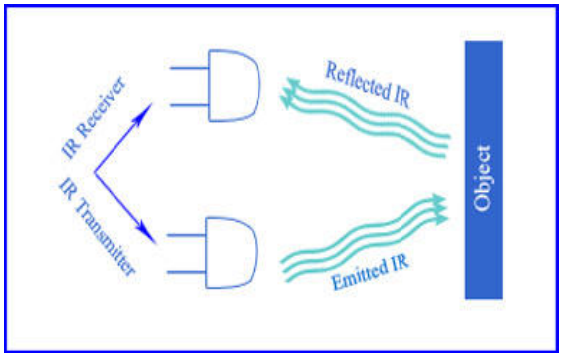

Figure 5: IR pairs

Here we used set of IR pairs to detect the object of different shape or size.

3. Results

Figure 6 shows flow diagram our proposed project in which initially when the system gets started looks for objects that were sensed by suitable IR detectors arranged on the conveyor belt which is rotating at constant speed.

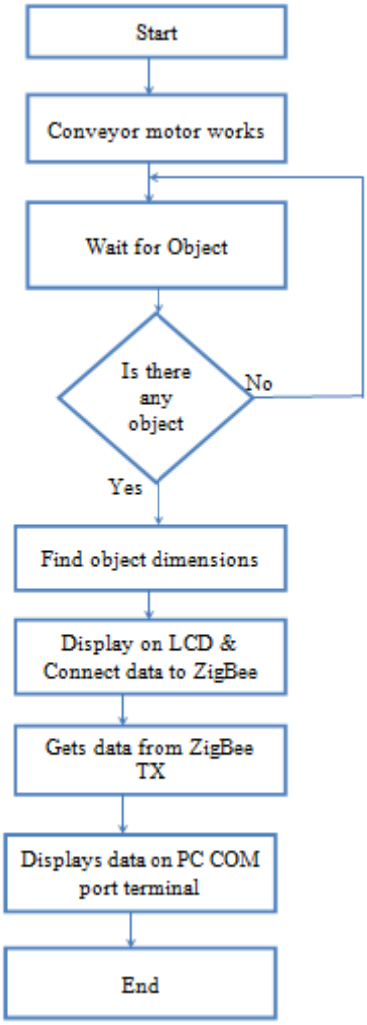

Figure 6: Experimental Setup

When the sensor detects object immediately places this data on serial communication port as well as LCD. Now the RF ZigBee sends this data to remote PC for displaying for user.

4. Future Scope

The Material sorting machine designed and fabricated by us is an elementary system. There is tremendous scope of improving this system and incorporating additional features, which will further its scope and facilitate its incorporation into a real time automation machine, some of the improvements possible are:

a. Introducing a robotic arm that will separate the different height of component and it will be put on another belt from where they can be collected.
b. Ensuring FOOL-PROFING so that the operator can never make a mistake of mixing of different height of material.

5. Conclusion

The concept of developing a Object sorting system with conveyor belt has been executed. We have developed an automated machine, which would be the precursor for the future developments. The conclusion of the proposed work is as follows:

1. In the past, there were no such materials handling system which can sort the object on the basis of their heights.
2. We have achieved a result in which the material can be sorted based on their different heights.
3. The size of the material will be shown in LCD and simultaneously sent to remote PC using wireless media.

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