

Application of Microcontroller in Assembly Line for Safety and Controlling

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Abstract-In The objective of this research is to design a control system for the assembly line in order to meet a set of practical engineering requirements and Product making companies have started to make a mark and succeed in Indian industry over the last few years by making use of automation. Traditional product making process works perfectly with human intervention but is unable to make fast with the growing demand of the customers. Wireless control system is designed to provide safety and comfort during use of the assembly line. The proposed system is based on both hardware and software. We use Bluetooth module or Wi-Fi that connects the hardware with a mobile device. Using Bluetooth or Wi-Fi, the assembly line can be operated without the need for obstructive cables. In order to complete the order within required time, the company has to put in additional manpower and at the same time, maintain the quality of the product. This can be achieved by using an automated SPM for large scale production for such demands. The proposed system works in standalone mode without the necessity of PC if once programmed.

In order to full fill the demands in shorter time span, automation of product making machines using microcontroller can come in handy. A mechatronics system that is developed for product making machine, which takes feedback from sensors and controls the function has been introduced. The paper also describes project to automate the process for product making. The project aims to reduce the manpower and increase the profit by increasing the production rate and quality. It also aims to reduce the material wastage due to manual handling.

Keywords-Product making machine, Low Cost Automation, Microcontroller, PLC, assembly line , Wireless sensor networks and module, Bluetooth module, Wi-Fi, e.t.c. .

1. INTRODUCTION

In almost all manufacturing industries where there are fully automated assembly lines such as dosing systems, mobile manufacturers, mining, food industry, packaging industry or agriculture are used. Trials are conducted on one or more assembly lines. From start to finish the products are moving on belt and the processes are done in between, while they are moving. Nowadays, wireless control of the machine plays an important role that is to reduce the manual work and save funds for the enterprise.

Low cost automation constitutes the use of standard components to mechanize machines, systems and processes. These automated machines can be operated by semi-skilled or unskilled labours as it requires very less human interpose. Providing optimum quality to the customers is one of the most important goals of any industry. The ability to manufacture high quality products is highly preferred in industries as high quality products encourage customer loyalty and results in increasing market share. To overcome all the problems and provide better solution a new idea of automation assembly line .

In fact, this aspect of food manufacturing is one of the areas that have received the most attention in terms of automation. Also automation increases profit which not only adds to shareholder value but also allows management to invest strategically in improving product quality and productivity as both of these contribute directly to improve profitability.

2. NEED OF MICROCONTROLLER

In order to achieve optimal production rates use of automated machines is a necessity. Automated machines are time saving which gives the manufacturer a competitive edge over other. The quality of the work is better and always remains the same.

An automated machine reduces the wastage of material which leads to proper utilization of the resources. Workers may suffer from fatigue which lowers the quality of job. Use of an automated machine lowers the labour dependency of a manufacturer. To achieve all of the above stated advantages low cost automation of product making machines using microcontroller is handy. Microcontrollers are used in **automatically controlled** products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other **embedded systems**. By reducing the size and cost compared to a design that uses a separate **microprocessor**, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. **Mixed signal** microcontrollers are common, integrating analog components needed to control non-digital electronic systems. In the context of the **internet of things**, microcontrollers are an economical and popular means of **data collection**, sensing and **actuating** the physical world as edge device. Some application of microcontroller are:

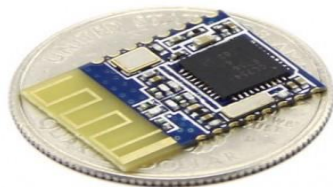
- **Personal information products:** Cell phone (Mobile phone), pager, watch, pocket recorder, calculator.
- **Laptop components:** Mouse, keyboard modem, fax card, sound card, battery charger
- **Home appliances:** Door lock, alarm clock, thermostat, air conditioner, TV remote, VCR, small refrigerator, exercise equipment, washer/dryer, microwave oven
- **Industrial equipment for controlling:** Temperature/pressure controllers, Counters, timers, RPM Controllers.

3. AUTOMATION WIRELESS TECHNIQUES:

A programmable logic controller (PLC) is a digital computer employed for automating electromechanical processes. PLCs are used globally in lot of industries. The PLC's are designed for multiple inputs and output arrangements; immunity to electrical noise, extended temperature ranges resistance to vibration etc. Programs to control the machine operations are basically stored in a non-volatile memory. Microcontroller is a term used for a small computer running on a single chip, which contains the memory, microprocessor and few accessories. Microcontroller comes in reduced size and affordable price as compared to other devices. Microcontrollers can accommodate accessories like analog to digital converter, digital to analog converter, programmable timer, counter etc. Powerful and carefully chosen electronics embedded in the microcontrollers can run almost any system. PLC requires a computer to operate, programming software and a PLC control console but a microcontroller combined with some accessories can complete the job of automating a machine. The cost of PLC based controllers is more than that of microcontroller units. PLCs are flexible than microcontroller units but for automation of product making machine, flexibility criteria is very low in the requirements. Due to these reasons, the microcontroller technique is highly suitable to achieve automation of product making machine. Hence, in making product making machines microcontroller technique is optimal to go with.

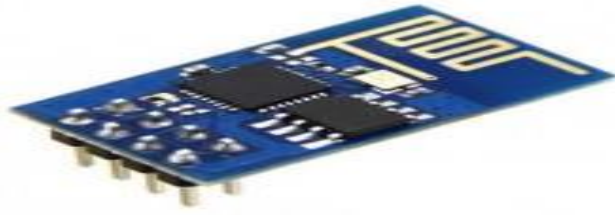
A. Bluetooth:

Bluetooth is and will be one of the most used wireless protocols in IOT specifications, especially with the recent introduction of Bluetooth Low Energy extension, also known by Apple users as I- Beacon. It operate at 2.4 GHz of radiofrequency hopping spread spectrum technology. It support data rate up to 1 Mbps and range is approximately 30 feet but today Bluetooth version is more advance. The advantage of this standard is its extremely low power consumption, which helps the making of full battery powered boards with a working time longer than 1 or 2 years in some cases. Another feature, already implemented on many smart phone, is the possibility to embed the management protocol directly at kernel level without requesting any intervention by the users. This facilitates the setup of a mesh network of Bluetooth devices, with lower latency and higher range respect to standard Bluetooth.



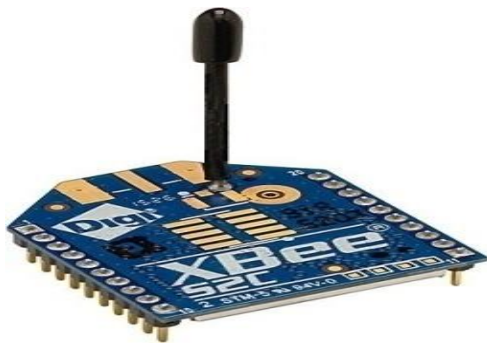
B. Wi-Fi:

Wi-Fi module is a Wi-Fi serial transceiver module, based on ESP8266 SOC. It is popular wireless communication technique for networked communication of devices. It supports IEEE 802.11 standard. It is support internet based protocol (IP) communication. In such communication each devices is identified by unique IP address. Wi-Fi based communication need an intermittent agent called Wi-Fi router. Wi-Fi router is responsible for restricting the excess to a n/w assigning IP address to a devices on network. Wi-Fi connections can be disrupted or the Internet speed lowered by having other devices in the same area. Wi-Fi protocols are designed to share channels reasonably fairly, and will often work with little to no disruption.



C. ZigBee:

ZigBee is a specification for a suite of high-level communication protocols used to create personal area networks (WPAN) built from small, low-power digital radios. ZigBee is based on IEEE 802.15.4 standard. Though its low power consumption limits transmission distances to 10–100 meters, ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. ZigBee is typically used in low data rate applications that require long battery life and secure networking (since it is supporting 128 bit encryption): home automation, healthcare, industrial control applications with short range and low bit rate.



D. Radio RF:

If GSM is “too much” for your project, while BLE4.0 or ZigBee features of networking and mesh network topology are not needed for your idea, the last (but not least) alternative you have are RF transceivers. Open-electronics is planning to sell very soon two of the highest rated boards among the Maker community, a 433MHZ solution and a 2.4GHZ solution. Radio frequency is produced by oscillating current a specified number of times and then radiating it off a conductor, referred to as an antenna, into empty space (this refers to space occupied by air rather than solid objects and does not refer to outer space) as electromagnetic radio waves. RF signals are sent and received using conductors through the phenomenon known as the skin effect, where RF current latches itself and flows through the surface of conductors rather than penetrating and passing through them like it does with other non-conducting solids. This effect is the core and basis of radio technology.



4. WORKING OF WIRELESS NETWORK:

Different sensors and module like Bluetooth, Wi-Fi, Radio RF, GSM and GPS. These modules are wireless control by the microcontroller.

5. MIROCONTROLLER:

ARM, previously advanced RISC Machine, originally Acorn RISC Machine, is a family of reduced instruction set computing (RISC) architectures for computer processors, configured for various environments. Arm Holdings develops the architecture and licenses it to other companies, who design their own products that implement one of those architectures—including systems-on-chips (SOC) and systems-on-modules (SOM) that incorporate memory, interfaces, radios, etc. It also designs cores that implement this instruction and licenses these designs to a number of companies that incorporate those core designs into their own products. Processors that have a RISC architecture typically require fewer transistors than those with a complex instruction set computing (CISC) architecture (such as the x86 processors found in most personal computers), which improves cost, power consumption, and heat dissipation. These characteristics are desirable for light, portable, battery-powered devices—including smart phone, laptops and tablet computers and other embedded system. For supercomputers, which consume large amounts of electricity, ARM could also be a power-efficient solution. Microcontrollers are "embedded" inside some other device (often a consumer product) so that they can control the features or actions of the product. Another name for a microcontroller, therefore, is "embedded controller." The actual processor used to implement a microcontroller can vary widely. For example, the cell phone shown on [Inside a Digital Cell Phone](#) contains a [Z-80 processor](#). The Z-80 is an 8-bit [microprocessor](#) developed in the 1970s and originally used in home computers of the time.

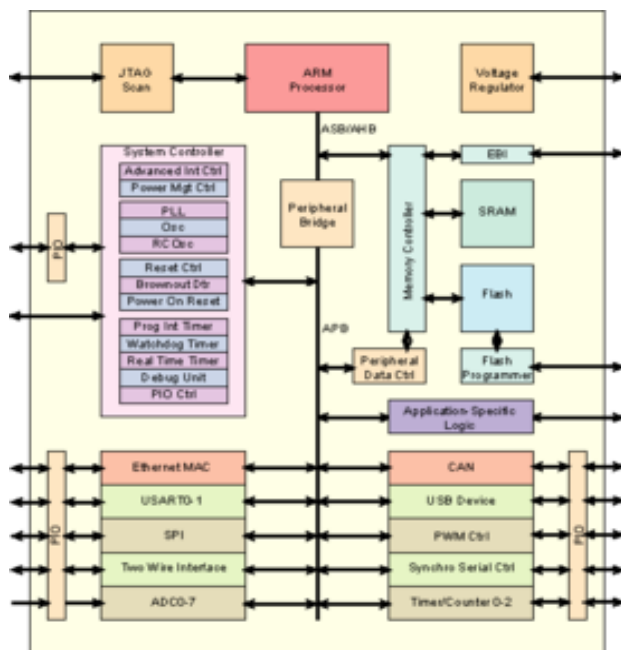


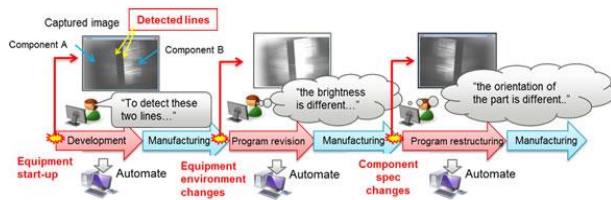
Figure1. Description of microcontroller

- Typical Conveyors Used in Line Automation
- Multi-strand chain conveyor, Turntables and Chain Driven Live Roller Conveyors for heavy duty assembly line systems.
- Slider bed belt conveyors are ideal for transporting light or irregularly shaped items
- Table top conveyor for light assembly operation.
- Hinged Steel Belt conveyors for part and scrap handling.
- Multi-Strand-Chain conveyors for heavy appliance assembly lines.
- For lines with walk on requirements, Pallet pro is ideal.
- Incline parts conveyors and plastic belt conveyors for parts handling.
- Shuttle Carts - AGV's for automated material handling.

A. Process flow and machine layout:

The machine is divided into 4 assemblies, namely

- 1) Feeding assembly
- 2) Die assembly
- 3) Cutting assembly
- 4) Shaping assembly



6. ALGORITHM OF THE PROCESS:

Before starting the machine the die plate should be adjusted for obtaining desired shape of the product. This can also be done by using controllers that can be similar to the process that takes place in an automatic tool changer in CNC machines. When the feeder is loaded with in the material, the sensor senses the flow of material and turns on the motor coupled to feed screw whose prime function is to push the material ahead for extrusion through the die plate. Then the output at the feeders end is sensed by the length limiter sensor whose output is coupled to the cutter motor and has a prime function of accurately cutting of required volume on the basis of length of extrude from the die. The output signals simultaneously switches on the shaper motor. The sensor at the output of the shaper senses the number of units produced by the machine and turns off the system if there is no output for a particular time.

7. FUTURE OF MACHINE:

The machine currently operates with the help of basic mechanisms like Feeding, extruding, cutting and shaping. The current design can form one shape at a time, a more advanced machine having multiple hoppers and feeders can be developed for manufacturing multiple products simultaneously. A faster feed screw engraved with good technology can be used. Also the output can be obtained at both the ends to save time and obtain volumetric accuracy. The system can be scaled heavy production. If we use AI in a technology that has permeated most industries and even consumer products and also worker. Reasons that are driving this prominence include the data driven applications that can be created. For businesses, it's a great investment portfolio and can be integrate with other technologies or systems. We will reduce the fault in production line and much safe to old working process.

8. CONCLUSION:

By using the available data and information on various automation techniques and mechatronics systems the future machines can be developed by automating and reducing the basic time consuming processes. It can comply with simple as well as complicated design and allow use of low cost reliable components. The machine automated for making sweet making process by using microcontrollers will cost be cost effective as compared to other machines build with conventional controllers. Hence, the Low cost automated sweet making Machine is successfully developed which can benefit small Industries and manufacturers, adhering to Safety of the workers and quality to be maintained. We use AI or machine learning to efficient and safe for manufacturer and consumer.

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