

METAL PRODUCTS DESIGN AND FABRICATION OF SMART SHELF SYSTEM

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Abstract - Smart shelves are one of the most important technologies that needed in the industrial world to get track of all the inventory that the industry has brought for production this information is most important factor for sustained production. Smart shelves use sensors and digital displays to deliver detailed product information suggestions while also giving shops important knowledge into employee preferences and work routines.

One of the main issues the retail business is now facing is the lack of stock items in stores, which causes employee unhappiness. Smart shelves technology is a best thing for industry for automated stock availability tracking and notify when there is any outage where things are running low or have been lost from their original location. Smart shelves can be connected to the internet and provide useful information on employee behaviour and how to dynamically adjust their in-store experience.

Key Words: industrial Internet of things, smart sensor, Sensor Network, instantaneous alerting system

1. Introduction

Design and fabrication of a scanning smart shelf system Smart shelves, popularly known as "intelligent shelves," are electronically connected shelves which are designed to keep track of inventory tools at any retail outlet automatically. Sheets will be employed in the manufacturing process since they are inexpensive and easy to deal with. Handles and fasteners like as screws are also used in the Smart Shelves System's construction projects. Cutting, bending, drilling, welding, and finishing have been among the process steps in this project. The project's main objective was to design and fabricate a smart shelf system.

These technology helps industries to keep track of inventories in the industrial environment at the fullest.

1.1 Objective

The objective is to design and fabricate smart shelves system to count the number of components, to fulfill the need of workers by denoting a count of a component that is portable, to design a smart shelf system which not only

act as a tool box but it is also multifunction. The smart shelf system is capable of identifying the activities going on it in real-time. It is notifying the out of stock of items. On the other side it will show the identity of the workers who needs the products from it. The future work to improve this system will be to design a smart trolley with it so that the items of same weight cannot be misplaced from the shelf.

1.2 Methodology

There are three essential elements of system architecture to take into account:

It should be in row with the strategic goals of the business. The architecture team should be in responsibility of communication with system architecture stakeholders and understanding their concerns. Three essential attributes of system architecture should be spotlighted:

1. It should be in line with the company's commercial objectives.
2. It must give the resources that stakeholders require to carry out their roles. This street is indeed. The architecture team ought to be in charge of interfacing with system architecture stakeholders and resolving their concerns.
3. In an industry software is the most important aspect that make the industry automatically run according to the aspects if an industry.

2.Process Flow

The design and working of smart shelf system is shown. It clearly explains how the system starts and step by step process is meted out. After following these steps we are now primed to get the real-time information of the activities which happening the shelf. Each block within the shelf will contain similar reasonably products for convenience of workers. When the things are kept on the shelf, the entire weight of the products are going to be measured by load cell so total weight of the shelf are going to be send to the most room by using Wi-Fi technology. This may show the supplier about the entire number of things within the shelf in real-

time. The system is split into two parts one is user end and other is admin end. The steps followed for designing the system are:

1) The flow chart shows the initialization of the system where the worker and therefore the admin both opens the door by swiping. After this their identity are going to be send to the room where it'll be matched. The shelf door will open provided that identity is matched, otherwise the shelf door won't open. Thus the system will get total information of the one who is using which shelf. 16

2) If the person picks up any item the load of that item are going to be subtracted from the whole weight and also the person sitting within the room are going to be ready to identify what number items are remaining within the shelf.

3) If the amount of weight decreases from the brink value the notification are going to be send to the room.

4) The person (admin) who monitors the full situation will get the notification about the shelf items getting extinct. Thus the admin will refill the things which are out of stock. Thus out of stock problem are going to be resolved.

5) Finally the door are going to be closed after a while if no activity occurs.

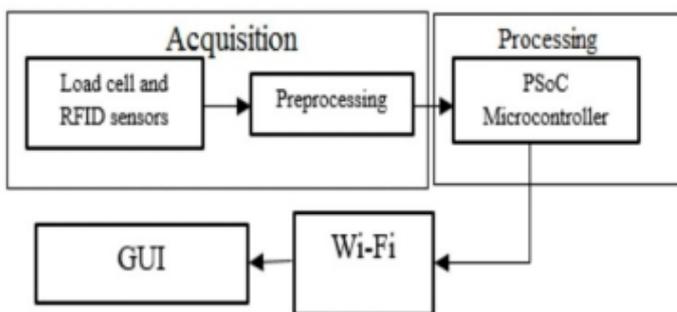


Fig .2.1 Process flow diagram

3.1 Process sheet

Process Sheet may be a document that features a series of performance instructions and for the method to supply an associated product, service or other outcome. Process sheets are widely utilized in manufacturing to illuminate standard procedures and directions dedicated to producing or installing a sort of system. Process sheets are developed for various departments and workshops as guidelines that designate the way to perform installation or manufacturing of certain products/systems. A typical process sheet consists of the subsequent sections:

1. Product/system description: what to provide or install

2. Process description: what stages are involved in product/system manufacturing/installation

3. Procedures & instructions: the way to produce/install the product/system

4. Labor & technology: who will produce/install the product/system and what tools & equipment are used

5. Budget: what amount of funds is required to implement the method?

3.2 Component specification

A Component Specification (CSPEC) might be a generic description of a component. It defines its dependencies to other components, what actions which can be performed thereon and therefore the way those actions affect the dependencies. It also specifies which artefacts the component is allowed to export to other components.

3.2.1 Load cell

A load cell is also a kind of transducer, specifically a force transducer. It converts a force like tension, compression, pressure, or torque into an electrical signal which is able to be measured and standardized .When the force applied to the load cell increases, the electrical signal changes proportionally. Load cells are accustomed measure weight. Load cells generally incorporates a spring element on which strain gauges are placed. The spring element is often product of steel or aluminum which implies it's extremely sturdy, but also minimally elastic because the name "spring element" suggests, the steel is slightly deformed under load, on the opposite hand returns to its starting position, responding elastically to every load. These extremely small changes are going to be acquired with strain gauges. Then finally the deformation of the gauge is interpreted by analysis electronics to figure out the load



Fig. 3.2.1 Load cell

3.2.2 HX711 Module

The HX711 Dual-Channel 24 Bit Precision A/D weight Pressure Sensor Load Cell Amplifier and ADC Module is also a simple breakout board for the HX711 IC that allows you to easily read load cells to measure weight. By connecting the module to your micro-controller you'll be able to read the

changes within the resistance of the load cell and with some calibration. This could be handy for creating your own industrial scale, process control, or simple presence detection. The HX711 Weighing Sensor transmits via a two-wire interface (Clock and Data). Any microcontroller's GPIO pins should function, making data reading simple.

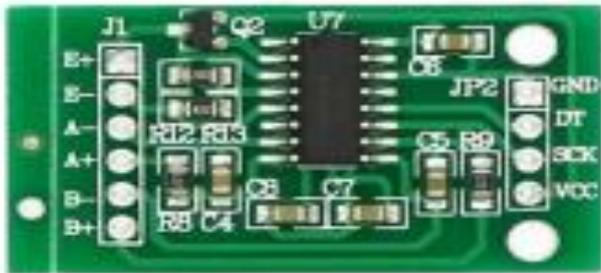


Fig. HX711 Module

3.2.3 NODE MCU

The term "Node MCU" refers to the firmware rather than the development kits that go with it. Node MCU is an open source IOT platform. It includes firmware which runs on the ESP8266 Wi-Fi from Es press if Systems, and hardware, which relies 29 on the ESP-12 module. it's supported the project and built on the Es press if Non-OS SDK for ESP8266. It uses many open source projects, like spiffs. Node-red is browser-based programming software that's accustomed wire hardware devices and API and online services interestingly. It's flow-based programming like lab view apart from LabVIEW it's open-source whereas LabVIEW is an open-source language programming tool. It is a large range of nodes that palette which is able to be deployed to its runtime during a very single click. This JavaScript are often deployed with a lucid text editor in it. It's made of mode.js which takes advantage of its node.js event-driven, non-blocking, and co-existence model it can run on a low-cost system rather like the raspberry pi. Every flow created are converted into JSON format and will be exported and sent into other systems.



Fig. 3.2.3 Node MCU

3.2.4. LCD Display

A liquid-crystal display. Made of liquid crystal which shows character in monochrome format. They communicate using serial or I2C communication Instead of emitting light

directly the liquid crystals employs a backlight or reflector to supply images in color or monochrome.



Fig. 3.2.4. LCD Display

3.2.5. ARDUINO UNO

Arduino is an open-source electronics platform equipped with easy-to-use hardware and software. Arduino's boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and switch it into an output - activation of a motor, turning on LED, publishing something online. You'll be able to tell your board what to try and do by sending a collection of instructions to the microcontroller on the board. To try to so you employ the Arduino artificial language (based on Wiring), and also the Arduino Software (IDE), supported Processing.



Fig. 3.2.5 ARDUINO UNO

3.2.6. Push button

The control may be a smooth edged rectangle containing the given text. The text is centered within the control. Whenever the user chooses the control, the control sends a message to its parent. The switch sometimes won't activate and off the feedback circuit, and it's a sort of control switch appliance that's widely used. It's employed in electrical automatic control circuits to manually send control signals to regulate contactors, relays, electromagnetic starters, etc.



Fig. 3.2.6. Push button

3.2.7. Connecting wires

Connecting wires allows an electrical current to travel from one point on a circuit to a different because electricity needs a medium through which it can move. For better electrical conductivity copper is mainly used in electrical cables for rare and cost effective big cable aluminum is used.



Fig.3.2.7. Connecting wires

4. Sequence of Operation

The smart shelf is one among the emergent technologies expected to remodel the retail industry altogether. These IOT connected solutions are said to assist the brick-and-mortar locations, which are often found fighting for his or her consumers over ever. to stay in pace with the increasing competition from the web setting, retailers should rethink their in-store marketing strategies and embrace the ground-breaking technologies like smart shelves. Integrating smart shelves – the electronically connected shelves into the present business operation will benefit retailers in various ways. It automatically keeps track of the inventory in an exceedingly retail establishment, which helps to live customer’s interest in an exceedingly specific product, and also streamlines their lives by offering in-depth details about it After connecting the load cell as above, you wish to calibrate it first before going for the ultimate design. So first calibrate the entire assembly unit. You’ll need add HX711 library to create the code compile. To investigate the capabilities of the proposed framework, we used two illustrative applications: a manipulator arm controller and a Δ/Σ converter. The overhead caused by the Simulink integration step adjustment when detecting a System C event has been measured in a very maximum of 10% of total simulation time. The overhead caused by IPC (Inter Process Communication) used for the context switch and also the communication layers has been measured so as of maximum 20% of the whole simulation time. The price of the added synchronization 36 functionality within the case of System C is negligible and doesn’t exceed 0.02% of the entire simulation time.

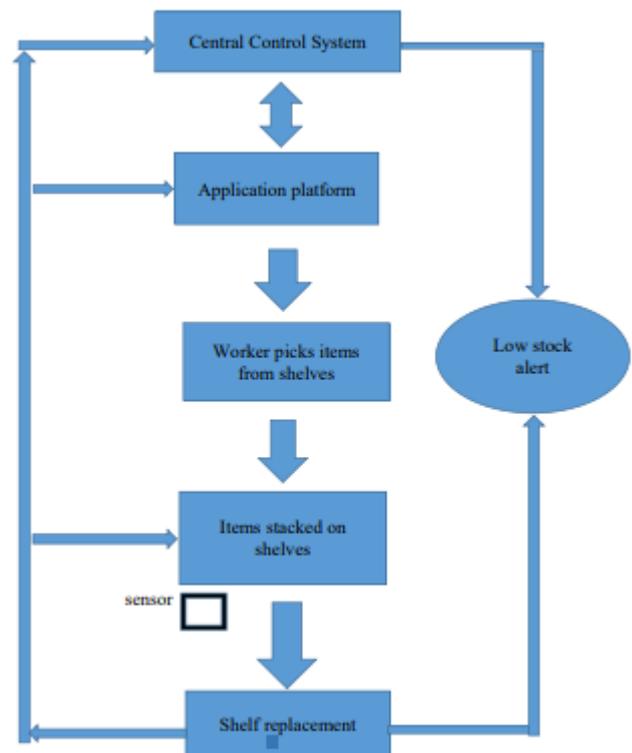


Fig.4.1. flow diagram

5. System Architecture

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5.1. Model of the Setup

3D modeling could be a part of rapid prototyping. Rapid prototyping is that the rapid development of a physical component, model or design using 3D CAD (computer-aided design). Using additive manufacturing, or more accurately described as 3D printing, the assembly of the component, model or assembly is usually completed.

- Rapid prototyping may be a set of methods that are accustomed easily create a 'model of a physical part' or structure using 3D CAD.

- The component or assembly is generally made by way of 3D or manufacturing technology with "additional layer." 24

- This 3D prototype plays a vital role within the development of recent products.

- It also helps the designer to search out the problem



Fig no. 5.1 3D Diagram

5.2. Complete System Architecture

Whole-system architecture may be a change management methodology that recognizes the organization as a living, organic whole that has to change in an exceedingly coordinated way; and to try to so in an exceedingly way which will maximize the commitment and ownership of these who live within the organization. Whole-system architecture could be a process designed to make significant change within the culture and work processes of a corporation and produce significant improvement in performance. If your organization encompasses a relatively traditional culture, you wish WSA to have interaction your people, gain understanding a commitment to vary. If you simply have to make small improvements, to have interaction people in continuous improvement, you are doing not need WSA. The American auto companies desperately needed to form significant change in their culture, but rather than a significant approach to analyzing and changing the 25 culture, they opted for a less

threatening and few dramatic approach of small groups functioning on.

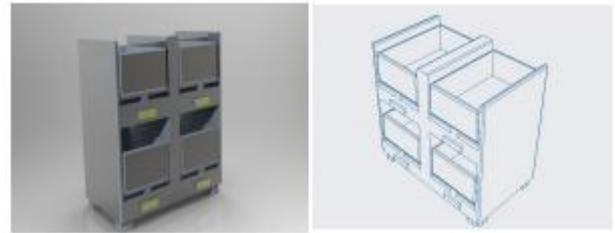


Fig. 5.2. 3D Diagram

6. Result

A controlled experiment often compares the results obtained from experimental samples against control samples, which are practically just like the experimental sample apart from the one aspect whose effect is being tested (the independent variable). A decent example would be a drug trial. The sample or group receiving the drug would be the experimental group (treatment group); and therefore the one receiving the placebo or regular treatment would be the control one. In many laboratory experiments its good practice to own several replicate samples for the test being performed and have both a positive control and a negative control. The results from replicate samples can often be averaged, or if one among the replicates is clearly inconsistent with the results from the opposite samples, it is discarded as being the results of an experimental error (some step of the test procedure may are mistakenly omitted for that sample). Most often, tests are tired duplicate or triplicate. A positive control may be a procedure the same as the particular experimental test but is understood from previous experience to allow a positive result. A negative control is thought to allow a negative result. The positive control confirms that the fundamental conditions of the experiment were able to produce a positive result, whether or not none of the particular experimental samples produce a positive result. The negative control demonstrates the base-line result obtained when a test doesn't produce a measurable positive result. Most frequently the worth of the negative control is treated as a The result is obtained by subtracting the previous value with the current values Sometimes the positive control takes the quadrant of a regular curve.

7. CONCLUSION

The product is developed to identifying the activities going on it in real-time. It is notifying the out of stock of items. On the other side it will show the identity of the workers who needs the products from it. The future work to improve this system will be to design a smart trolley with it so that the items of same weight cannot be misplaced from the shelf. The prototype developed achieved impressive results in the

stress tests, with 99.9997% read rate, and all item packages tracked. This result can be considered a consistent proof of feasibility for RFID technology in smart shelf applications. The prototype developed achieved impressive results in the Stress tests, with 99.9997% read rate, and all Item packages tracked. This result can be considered a consistent proof of feasibility for RFID technology in smart shelf applications.

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