INDUSTRIAL PRODUCTION AND WASTE MONITORING SYSTEM

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***Abstract*—Internet of things (IOT) has linked the real and virtual world. IOT system is a universal global network. The system read, stores and displays the calculated and sensed data. Our project is based on production monitoring and waste analysis system using Internet of Things (IOT). Now-a-days automation is preferred in every field especially in manufacturing sector improving the performance of system. In this system electrical sensors are used to measure physical parameters which are converted in to electrical form to c**We If. **the relevant values in the form of machine language to electronics systems. This system gives the detailed analysis as well as data base required for estimating the exact count of the generated product at each level of production of the plant start from raw material processing to final product packaging.**

This paper introduces a model to measure and display the weight of material in industry. Electromechanical device load cell is used to measure the load, it works as a transducer. Hx711 is used to interface the load cell and Arduino UNO. A Wi-Fi module ESP 8266 is also used to send the data to user.

Keywords— **IOT (Internet of things), automation, sensors, Arduino Uno, ESP 8266.**

I. INTRODUCTION

Advances in wireless technology have opened up new opportunities for a better system. This technology is capable of providing reliability in addition to enhanced mobility. Automation is today's need; the biggest benefit of automation is that it saves energy, improves the quality, gives the accuracy, and also saves labor cost. In future we can see the wide integration of IOT with existing technologies [1]. Internet of things (IOT) is a network which contains physical (electronic) devices to communicate and sense with software system through internet. The system has the ability to send data over a network without having any interaction with human to human or human to computer [1]. IOT has provided an opportunity to build a powerful industrial system and applications. Industry 4.0 is the main reason for the new evolution for smart industries [2].

Factors enabling for IOT [5]-

1) Human beings that are consumers as well as producers for data
2) Cloud computing that is able to scale rapidly to meet the growing demand resulting from the IOT in terms of storage and computing power
3) Widespread use of smart devices
4) Communication networks
5) Smart technologies
6) Need of automation
7) Competition among industries

Advantages of IOT [5]-

1)IOT in manufacturing industry.
2)In food/water production processing
3)Sensing system
4)Collection of data is highly capable
5)Easy for service and maintenance
6) Analytics capabilities

II. PROPOSED SYSTEM

At present industries are unable to measure and analyze the step wise data, wastage during production. We cannot get the actual final production that is desired as per the input. Thus the industry fails to achieve the target, suffers loss and economic growth decreases.

In this paper we proposed an IOT based electromechanical project for monitoring process of industries. For this we have selected food industry to implement and evaluate effectiveness of our system. The main aim is to develop and implement IOT based system to calculate the final product, quantity of the products, and also the waste of raw material during the whole process. This system will estimate the number of final product based on the weight of raw material and will also count the actual quantity produced .The difference between estimated quantity and actual quantity thatwill be marked as wastage can also be calculated trying to make the system user friendly. By this system we can easily find out the fault and will be able to take particular measures to reduce or avoid it [4].

III. CASE STUDY

The main aim of any production industry is to get better and proportional output as compared to the input of raw material. This project is basically based on food industry moreover the juice making industry (it may be of apple, mango, etc.). In a food industry the whole production is done batch wise systematically. A batch has a fixed quantity of raw material for the production process. A wide range of drinks can be produced by extracting fruit juice or fruit pulp.

Method of production -

a) Selection of raw material
b) Sorting the bad quality of material
c) Juice extraction
d) Filtration
e) Pasteurization
f) Filling and bottling

IV. Components Of The System

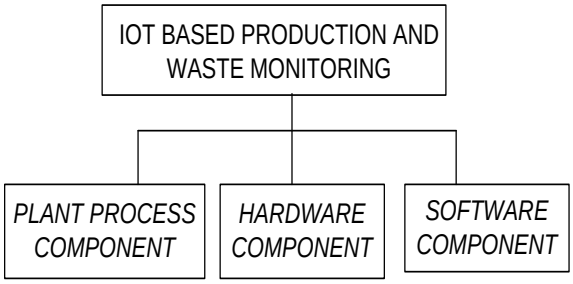


Figure 1:- Components of system

3.1 Plant process components

The food industry requires large quantity of raw material. In this the raw material some quantity of bad material is also present. When the raw material is taken for processing sorting is done to remove the bad quality of raw material. This quantity is measured by the load cell. Also at the end of process the actual quantity of product is also measured by another load cell. In this way the plant component are the load cells that will be used to measure the weight of the material. Figure no. 1 shows the components of system.

An IOT based system of an industry varies according to the nature of industry**.**

3.2 Hardware component

The following hardware components are used in our project-

a) Load cell
b) Transformer(step down)
c) Bridge rectifier
d) LCD 16x 2
e) Arduino UNO
f) ESP 8266

a) Load cell:

There are several methods to measure pressure or weight of a system. One of the devices is load cell. Load cell is transducer which converts the pressure or force that is input to electrical signal as output [10]. Load cell has a spring material and strain gauge. The spring material creates a strain by the applied force and the stain gauge changes the resistance to electrical signals [11]. It has a Wheatstone bridge circuit inside made from four resistances that converts the force into electrical signal [11]. The spring element is designed such that the strain developed is directly proportional to load applied. The strain gauge utilizes this principle and is defined as a device whose electrical resistance varies in proportion to the amount of strain in the device [10].

With this load cell an Hx711 sensor is used.Hx711 is a weight sensor module which has precision of 24 bit analog to digital converter. It converts the low electrical output which is obtained from the load cell (mechanical energy) to digital form [15]. The digital converted output is transferred to Arduino Uno to display the weight. Hx711 is connected to load is connected to microcontroller the variations occurring in the load cell resistance will be read by the microcontroller.

b) Transformer:

Transformer is a static electromagnetic energy conversion device that transfers electrical energy from one circuit to another by the medium of magnetic field without change in frequency [6]. The transformer has two windings primary winding and secondary winding. The mains supply is given to the primary winding and the secondary winding delivers the electrical energy to load [8]. As the device is static the efficiency is more as compared to other rotating electrical devices, also less maintenance is required [6].

One of the parameter of transformer is voltage & turns ratio which depends upon the number of windings. As there are two windings of transformer one is input (primary) and other output (secondary).

If the number of turns of wire on primary is less than the secondary then it is step up transformer. If the number of turns of wire on primary is more as compared to secondary than it is step down transformer. This is illustrated in fig no.2.

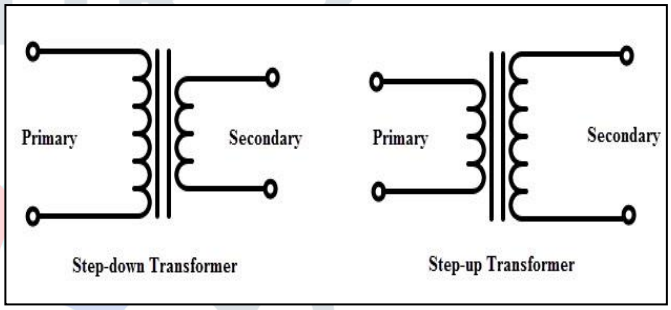
Figure 2:- Schematic diagram of step up & step down transformer

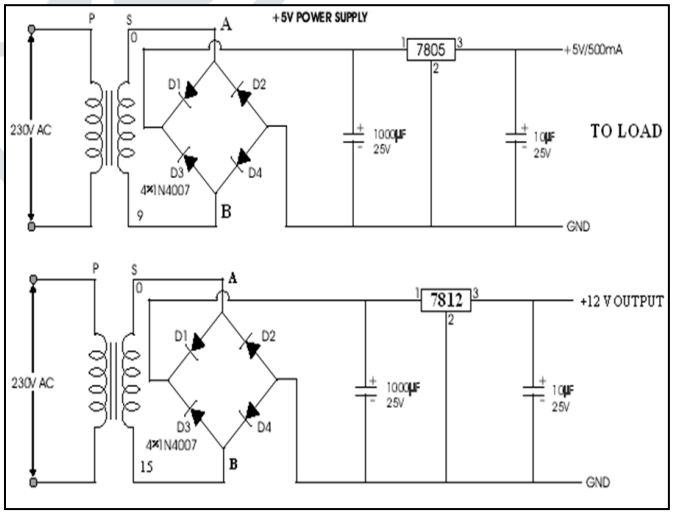
c) Bridge rectifier:

The bridge rectifier is conversion of an alternating current direct to direct current. The cost of bridge rectifier lowas compared to rectifier.

Figure 3:- Schematic diagram of single phase full wave bridge rectifier

$$\text{Turns ratio} = \frac{\text{Number of turns on the primary}}{\text{Number of turns on the secondary}}$$





d) Arduino UNO:

Arduino UNO is a microcontroller based board operating on Atmega328 microcontroller at 5v having 2kb of RAM 1kb of EPROM storing parameters and 32kb of flash memory for storing programs. The board consists of 14 digital I/O pins and 6 analog input pins [9]. It has inbuilt analog to digital converter on board [12].The clock speed is 16Hz. It has a USB connector for inserting programs in it [9]. It is open source mother board designed to interact with hardware which can sense and the connector control external devices through sensors and actuators [12]. The figure 4 shows the structure of Arduino UNO.It is programmed through Arduino IDE which supports C, C++, and JAVA language for programming [12].

The Arduino UNO board is classified into two categories-

i) Hardware and

ii) Software

i) *Hardware* –

It consist microcontroller , external power supply USB plug, internal program, reset button, analog pins, digital input output pins, power and ground pins.

ii) *Software* –

The program written in Arduino IDE is known as sketches. The Arduino IDE software is used for developing sketches for ESp8266.

It consists of text editor, message section, text, and console tool bar [13].

Figure 4:- Arduino UNO

Types of Arduino UNO [14]:

1. Arduino UNO
2. Arduino UNO Leonardo
3. Arduino UNO Mega
4. Arduino UNO Nano
5. Arduino UNO Mini
6. Arduino UNO Lily pad
7. Arduino UNO Mini pro
8. Arduino UNO BT

e) LCD:

LCD is electronic module with wide applications used for display which uses liquid crystals to produce image. 16 x2 means 16 characters in each 2 line. It has two registers command and data. The register pin is selected to change the register, RS=0 for command and RS=1 for data register. It has data 8 data pins, ground pin, supply pin, register select, read/write, enable, led pins.

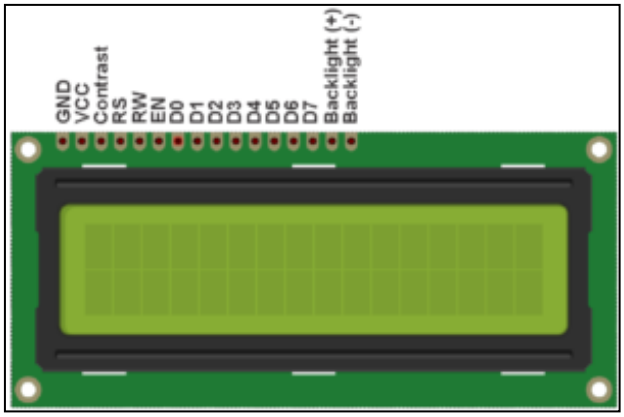
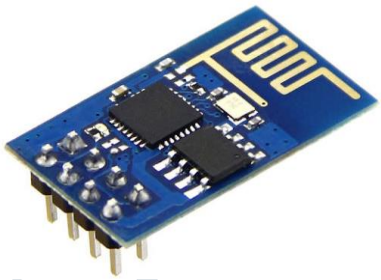


Figure 5:-LCD (LIQUID CRYSTAL DISPLAY)

f) ESP8266:

The ESP 8266 is a wireless



programmable microcontroller board. It is able to sense data from different sensor nodes of IOT based system and send the data to user.

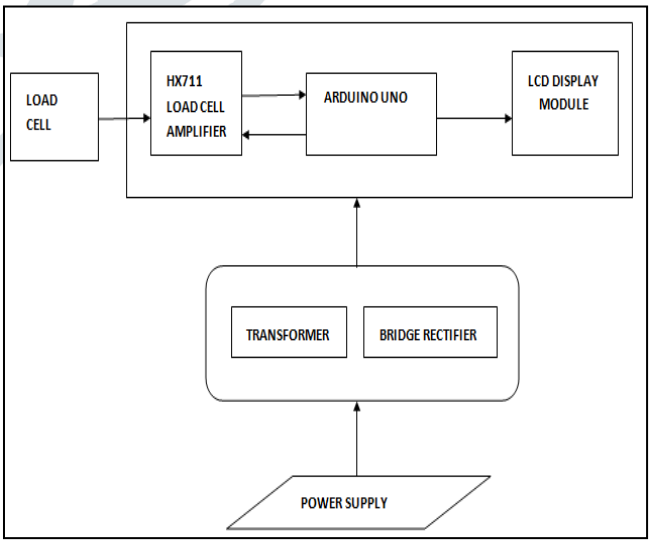


Figure 6:- ESP 8266

V. Architecture Of The System

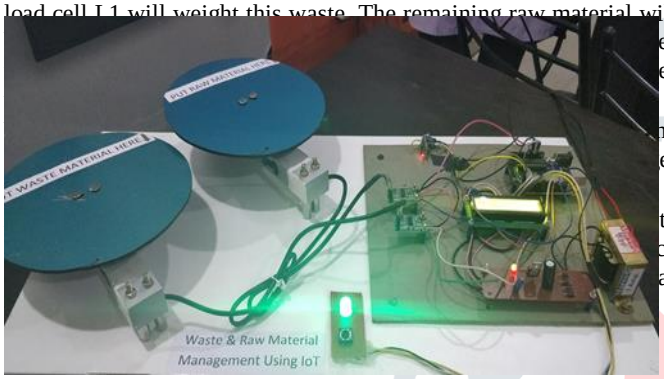
Figure 7 shows the architecture of the system. It shows how the components are acquired for designing the system using Arduino UNO microcontroller, a 40 kg load cell,ESP8266 Wi-Fi module, LCD 16*2, Hx711 load cell amplifier that plays the role of bridge between load cell and microcontroller.

Figure 7:- Architecture of the system

VI. Working

The project is basically based on production monitoring plant of a food (juice) industry. The Daily required raw material is fixed in a food industry. On that account for this we have taken the batch size of 4kg. Here we have used two load cells (L1, L2) which will provide the final product and waste during process.

When this 4 kg of raw material (apple) is taken for further process first sorting of bad material is done and is stored in a container. The load cell L1 will weight this waste. The remaining raw material will



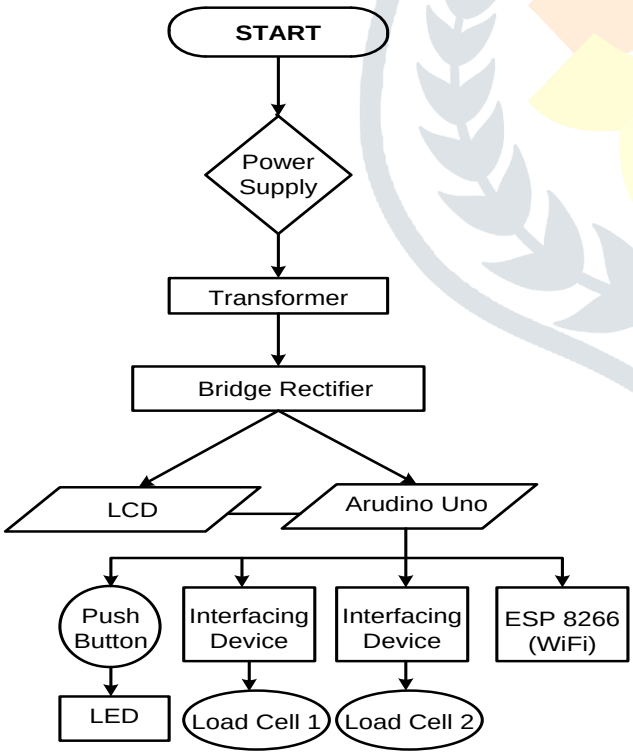


Figure 9:- Flow chart

4.1 Future Aspects

In future we can make it more advance by adding – a temperature sensor, ultrasonic sensor. It can be advanced to calculate annual profit or loss during production. It can be made fully automatic by some additional modifications.

VII. Result

The following are the results of our system after execution:

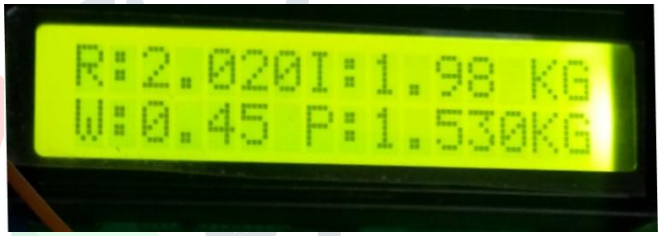


Figure 10:- Stepwise output shown by the LCD

For example-

1. Actual raw material = 4kg
2. (Load cell 1) Sorted material weight = 2.02kg
3. Then the material that went for crushing = 4 - 2.02=1.98kg
4. (Load cell2) final product = 1.53 kg
5. Waste after crushing = 0.45kg.

After this calculation we also get the number of units of 200ml of juice bottle. That will be based on the amount of final product.
As in the above example final product is 1.53kg. Then the number of 200 ml of bottles will be 7 bottles.

VIII. CONCLUSION

This IOT based application do the analysis of processing of the product developed by industries. It will play a role of useful tool for the administration for analyzing the data at each level of production in terms of waste generated. This may help the production unit to find the critical areas where possible losses in production occurs and will help to take appropriate corrective means to overcome it and improve the performance. This will increase the efficiency of the production and increase the profit of the company which is always the upmost aim of any utility.

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