iJRASET
International Journal For Research in Applied Science and Engineering Technology



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 11 **Issue:** IV **Month of publication:** April 2023

**DOI:** https://doi.org/10.22214/ijraset.2023.50501

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538*
*Volume 11 Issue IV Apr 2023- Available at www.ijraset.com*

# Smart Solution for Safe and Secure Packaging

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***Abstract:*** ***The intelligent packaging solution aims to use an electronic packaging solution to combat the problem of opening packages during transportation as well as to measure the characteristics of the product , the inner and outer atmosphere of the package .***
***The project IPS aims to use electronic packaging solutions to effectively trigger an alert when a package is opened . This is done by using many sensors in a fail-safe system.***
***The problem with single sensor-based systems is that they do not correlate data from different means . IPS uses many sensors that continuously track the physical parameters inside the packages to ascertain if the package has opened or there has been some rise in temperature (for pharmaceutical and temperature – sensitive products). Once this alert has been sent to those concerned, they can take necessary action .***
***Keywords: Internet of things , Smart freight box, RFID.***

## I. INTRODUCTION

Internet of thing (IoT) is not only a promising research topic but also a blooming industrial trend. Some problems that often arise in the packaging of products are difficulty and inaccuracy in determining appropriate packaging options according to type and condition the product to be packaged.
Incorrect decision of packaging option can cause quality loss, physical damage, spoil age of the packed products, especially perishable and time sensitive products. Security of data is of primary concern and the system is fully compliant with all data protection standards.
With the rise of e-commerce, there is an increasing need to manage online purchase deliveries effectively. The Internet of Things (IoT) is a scenario in which objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without requiring human or human-to-computer interaction.
IoT has evolved from the convergence of wireless technologies, micro-electromechanical systems (MEMS) and the Internet. With IoT, devices typically gather data and stream it over the Internet to a central source, where it is analyzed and processed.
With IoT, devices typically gather data and stream it over the Internet to a central source, where it is analyzed and processed. As the capabilities of things connected to the Internet continue to advance, they will become more intelligent by combining data into more useful information.
To handle such situations we propose a solution by automating the parcel collection unit. This project discusses about the part of IoT in home sophistication, the proposed approach.

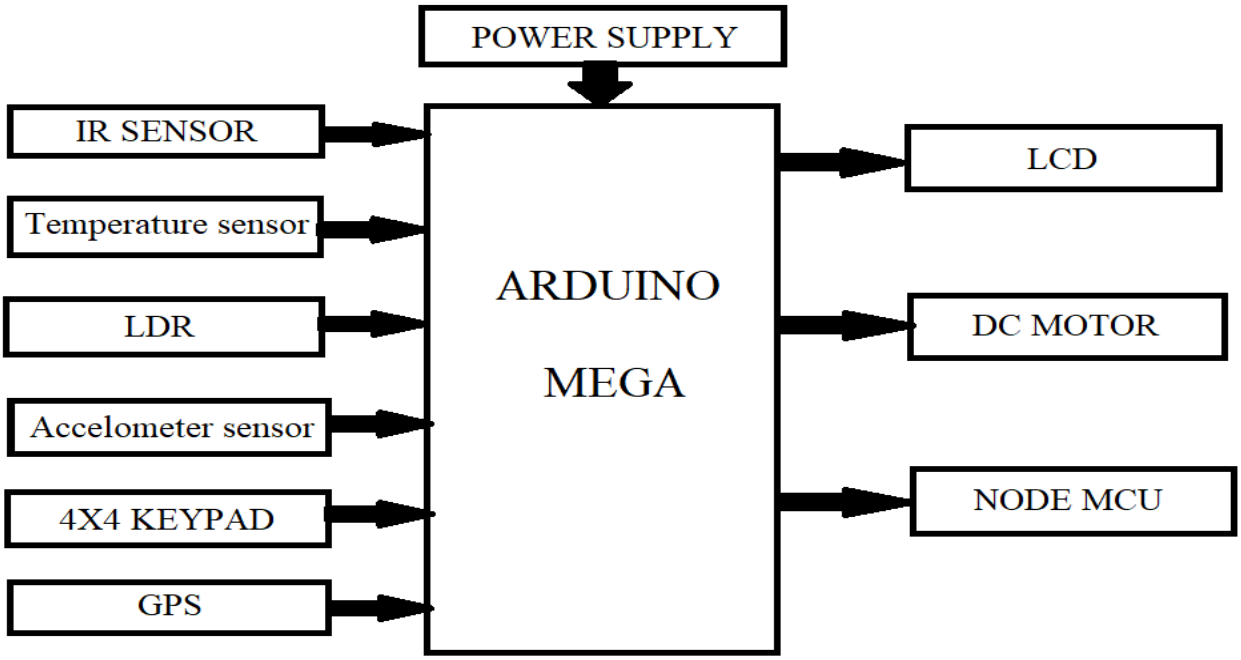
## II. METHODOLOGY

The Intelligent Packaging solution aims to use an electronic packaging solution to combat the problem of opening packages during transportation and as well as to measure the characteristics of the product, the inner and outer atmosphere of the package.
IPS uses many sensors that continuously track the physical parameters inside the package to ascertain if the package has been opened or there has been some rise in temperature.
Once this alert has been sent to those concerned, they can take necessary action. This will result in an OTP that is received at the customer's mobile number. Entering the OTP will reset the device.

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## III. BLOCK DIAGRAM




## IV. TECHNICAL REQUIREMENTS

### *A. Arduino Mega Controller*

The microcontroller board like "Arduino Mega" depends on the ATmega2560 microcontroller. It includes digital input/output pins-54, where 16 pins are analog inputs, 14 are used like PWM outputs hardware serial ports (UARTs) – 4, a crystal oscillator-16 MHz, an ICSP header, a power jack, a USB connection, as well as an RST button. This board mainly includes everything which is essential for supporting the microcontroller. So, the power supply of this board can be done by connecting it to a PC using a USB cable, or battery or an AC-DC adapter. This board can be protected from the unexpected electrical discharge*e by placing a base plate.

### *B. Arduino Mega Pin Configuration*

These pins are used for providing o/p regulated voltage approximately 5V. This RPS (regulated power supply) provides the power to the microcontroller as well as other components which are used over the Arduino mega board. It can be attained from Vin-pin of the board or one more regulated voltage supply-5V otherwise USB cable, whereas another voltage regulation can be offered by 3.3V0-pin. The max power can be drawn by this is 50mA.

### *C. GND*

Pin The Arduino mega board includes 5-GND pins where one of these pins can be used whenever the project requires. Serial Communication The serial pins of this board like TXD and RXD are used to transmit & receive the serial data. Tx indicates the transmission of information whereas the RX indicates receive data. The serial pins of this board have four combinations. For serial 0, it includes Tx (1) and Rx (0), for serial 1, it includes Tx(18) & Rx(19), for serial 2 it includes Tx(16) & Rx(17), and finally for serial 3, it includes Tx(14) & Rx(15).

### *D. Analog Pins*

There are 16-analog pins included on the board which is marked as A0-A15. It is very important to know that all the analog pins on this board can be utilized like digital I/O pins. Every analog pin is accessible with the 10-bit resolution which can gauge from GND to 5 volts. But, the higher value can be altered using AREF pin as well as the function of analog Reference ().

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*E. I2C*

The I2C communication can be supported by two pins namely 20 & 21 where 20-pin signifies Serial Data Line (SDA) which is used for holding the data & 21-pin signifies Serial Clock Line (SCL ) mostly utilized for offering data synchronization among the devices.

*F. Reset (RST) Pin*

The RST pin of this board can be used for rearranging the board. The board can be rearranged by setting this pin to low .

*G. SPI*

Communication The term SPI is a serial peripheral interface which is used to transmit the data among the controller & other components. Four pins like MISO (50), MOSI (51), SCK (52), and SS (53) are utilized for the communication of SPI.

*H. IR Sensor*

IR sensor is an electronic device that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes but infrared sensor can detect these radiations.The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode . Photodiode is sensitive to IR light of the same wavelength which is emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

*I. Temperature Sensor*

A temperature sensor is a device used to measure temperature. This can be air temperature, liquid temperature or the temperature of solid matter. There are different types of temperature sensors available and they each use different technologies and principles to take the temperature measurement.

*J. LDR*

LDR (Light Dependent Resistor) is a special type of resistor that works on the photoconductivity principle means that resistance changes according to the intensity of light. Its resistance decreases with an increase in the intensity of light. LDRs are used to detect light levels.

*K. Accelerometer sensor*

An accelerometer sensor is a tool that measures the acceleration of any body or object in its instantaneous rest frame. It is not a coordinate acceleration. Accelerometer sensors are used in many ways, such as in many electronic devices, smartphones, and wearable devices, etc.

*L. 4X4 Keypad*

Keypad is used as an input device to read the key pressed by the user and to process it. 4x4 keypad consists of 4 rows and 4 columns. Switches are placed between the rows and columns. A key press establishes a connection between the corresponding row and column, between which the switch is placed.

*M. GPS*

GPS trackers with IoT-enabled sensors provide the necessary navigation tools when moving around and can scan the surroundings of people with visual impairments to direct their movements and keep them safe. Tracking devices also provide additional safeguards in the form of personal locators.

*N. LCD*

LCD is a flat display technology, stands for "Liquid Crystal Display," which is generally used in computer monitors, instrument panels, cell phones, digital cameras, TVs, laptops, tablets, and calculators. It is a thin display device that offers support for large resolutions and better picture quality.

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*O. Node MCU*

Node MCU is an open source platform based on ESP8266 which can connect objects and let data transfer using the Wi-Fi protocol. In addition, by providing some of the most important features of microcontrollers such as GPIO, PWM, ADC, and etc, it can solve many of the project's needs alone.

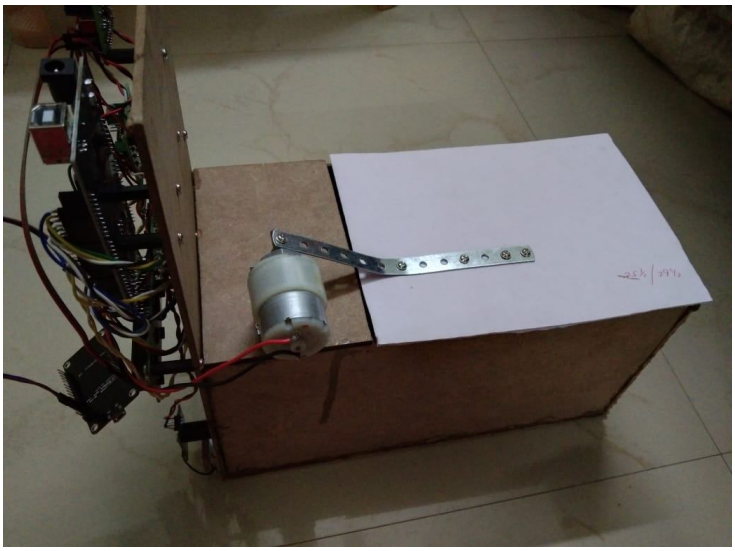
*P. DC Motor*

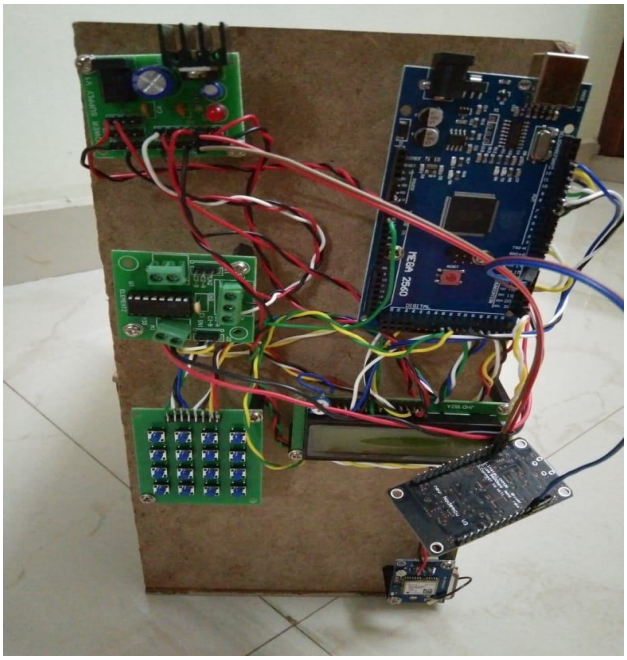
A direct current (DC) motor is a type of electric machine that converts electrical energy into mechanical energy. DC motors take electrical power through direct current, and convert this energy into mechanical rotation.

*Q. Power Supply*

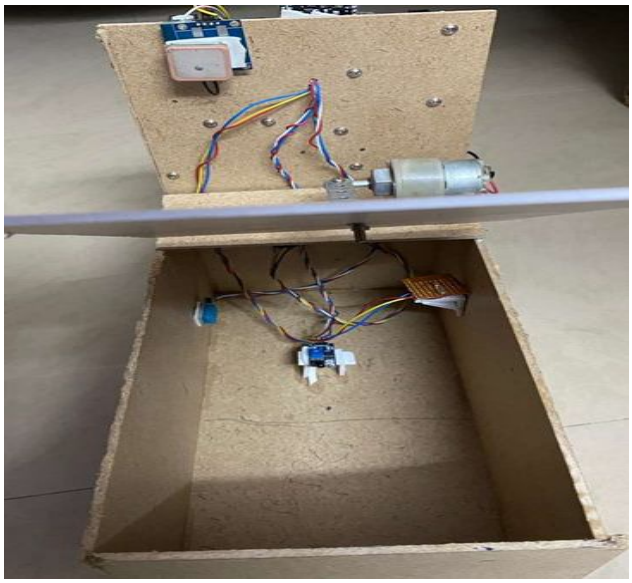
A power supply is an electrical device that supplies electric power to an electrical load. The main purpose of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters.

## V. IMPLEMENTATION

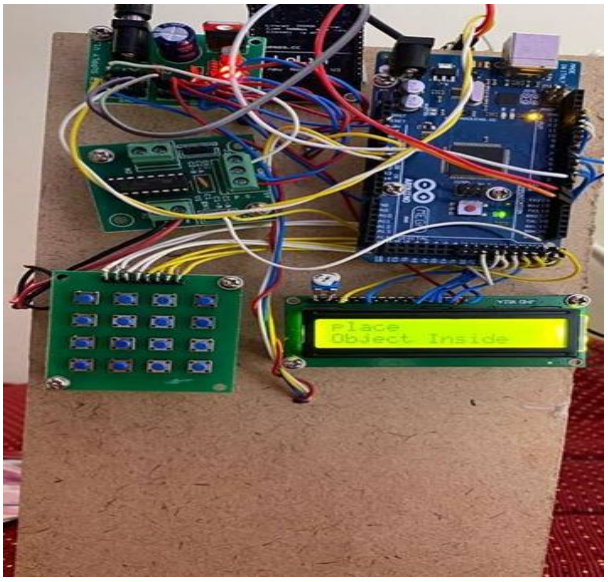




## VI. RESULTS



TOP VIEW




Before Placing package, Front View




After Placing




Warning




Object Detection

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## VII. CONCLUTION

We are designing and implementing the non-destructive package testing and verification solution using an electronic packaging solution called IPS development kit. The kit will be placed inside the package with enough space to work properly. The kit will travel within the box till the destination where it will be removed after the delivery If there is any tampering or intrusion during the delivery process an alert will be sent. By this we are maintaining the integrity of the product as well as the reputation of the companies that use this system and along with that, we are hoping to ensure customer satisfaction by getting them the product they requested without any problem.

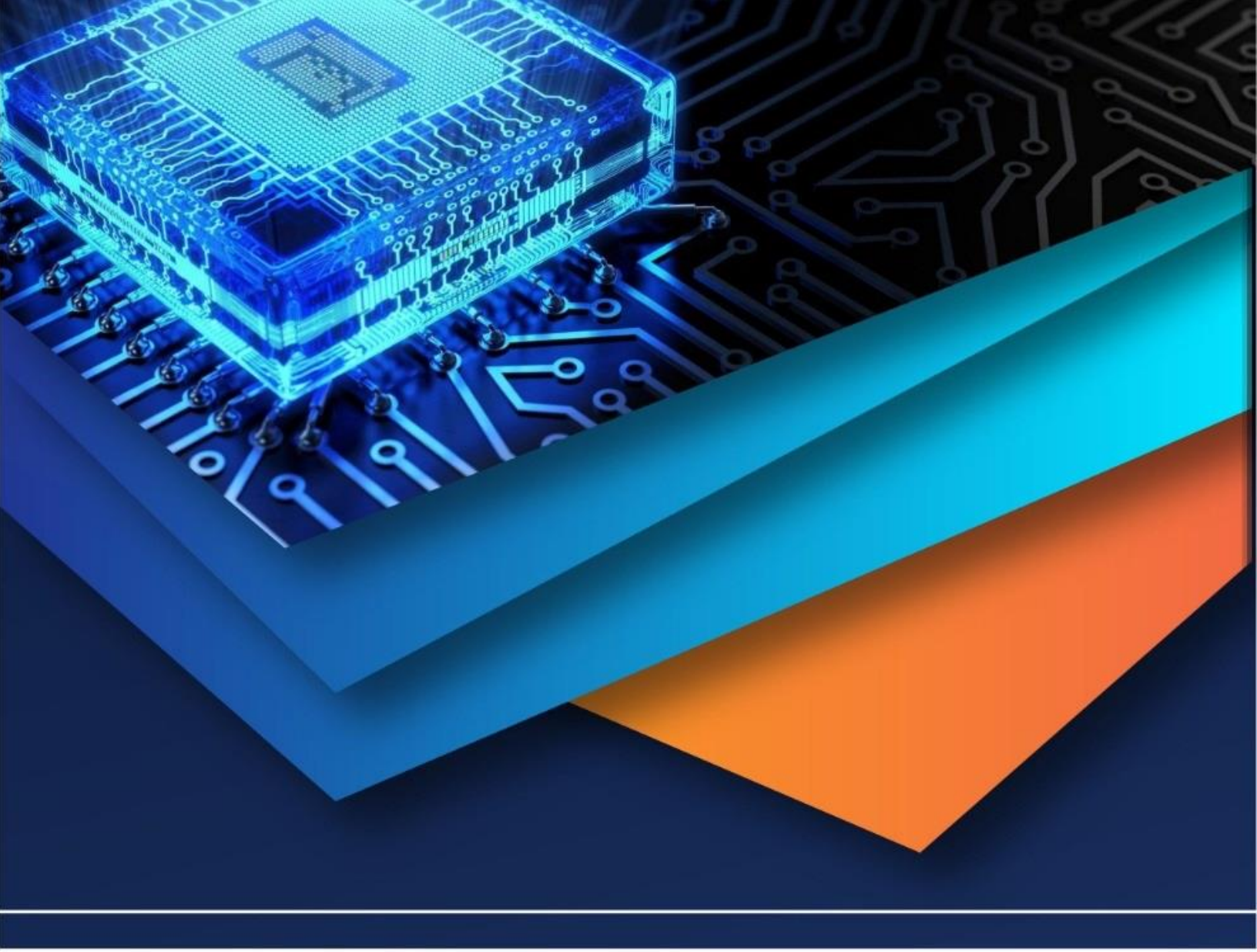
## VIII. FUTURE SCOPE

Below Feature can be added • Digital nameplate • Online administration • Multiple deliveries: Multiple parcels can be delivered each day by different service providers totally without delivery delays. • Time-saving: Saves time as no need for unnecessary trips to parcel collection offices. • Fast availability: No waiting times at goods collection points and no time lost due to shipping.

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