AN EFFICIENT SAND TROLLEY


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OUTLINE

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Introduction : Importance of application

- Introduction
  - Importance

- Usually masons have to scrap sand/cement from ground and carry it on their heads or have to scrap from ground and fill it in a trolley for carrying it.
- Such activities require much effort and are very painful. Scraping sand from ground requires much effort, there are chances of getting injury in head while carry heavy stuffs
- Sandor cement scraped is often mixed with stone particles or other debris.
- Masons cannot measure how much quantity of sand they are placing into the bag which often causes unknown quantity of sand getting mixed into mixture.

Problem Statement

- Introduction
  - Importance
- Problem Statement

Existing methods

- Present we have wheel barrow which is used to just take the sand and transfer it from one place to another

Drawback of existing system

- Sandor cement scraped is often mixed with stone particles or other debris. we cannot separate stone particles
- lack of features
- Masons cannot measure how much quantity of sand they are placing into the bag which often causes unknown quantity of sand getting mixed into mixture.
- in efficiency

Objectives

- Introduction
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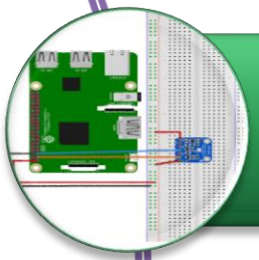
- Objectives

To study various sensors and related technologies



To design an efficient trolley for construction purpose

To develop a low cost trolley with various sensors

To deploy a smart trolley that helps workers in the construction areas

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National Status

This is the first and mostly used sand trolley model

Its commonly called as sand loading wheel barrow

FEATURES:

- its weight around 150 kg
- we can carry most of the things but it is mostly used to carry , dirt, rock, sand, mulch
- made of solid rubber tyred wheels with ball bearing for smooth moving.
- Most of the part is made up of metal

USES:

- it is easy to use, long service life and high durability
- we mostly see sand trolling wheelbarrow used for moving sand in construction sites and also in mining areas

Literature

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- Additionally, these are used in houses, big corporate, sugar factories, hospitals, supermarkets, and malls
- these are available at budget-friendly prices
- it takes less space and can be moved easily anywhere even in sand

DISADVATAGES:

- this type of wheelbarrow has only one wheel and so much of weight ends on our hands.
- we have to take the sand and fill into it and then again we have to shift into gunny bags it takes

a lot of energy.

Why our sand trolley ?

To overcome the disadvantages in the existing model we made a new model of sand trolley by adding some additional features

Features we will add:

- It is an integrated model with a scraping tool and detachable trolley
- We will add a filter which can filter the sand and can directly give the filtered sand without transferring and filtering anywhere
- The trolley has two wheels which will make less effort to hands.

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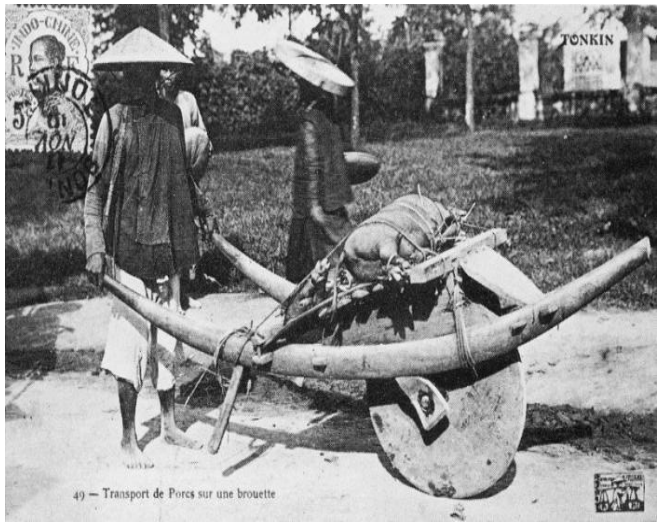
International Status

American poet William Carlos Williams praised them in his most famous poem: "so much depends upon a red wheelbarrow," he wrote in 1962. The fact is that whether they have one or two wheels, wheelbarrows changed the world in small ways. They help us carry heavy loads easily and efficiently. Wheelbarrows were used in Ancient China, Greece and Rome

Zhuge Liang(231 A.D)

According to the history book *The Records of the Three Kingdoms*, by the ancient historian Chen Shou, the single-wheeled cart today known as a wheelbarrow was invented by the prime minister of Shu Han, Zhuge Liang, in 231 A.D. Liang called his device a “wooden ox.” The handles of the cart faced forward (so that it was pulled), and it was used to carry men and material in battle.



Architecture

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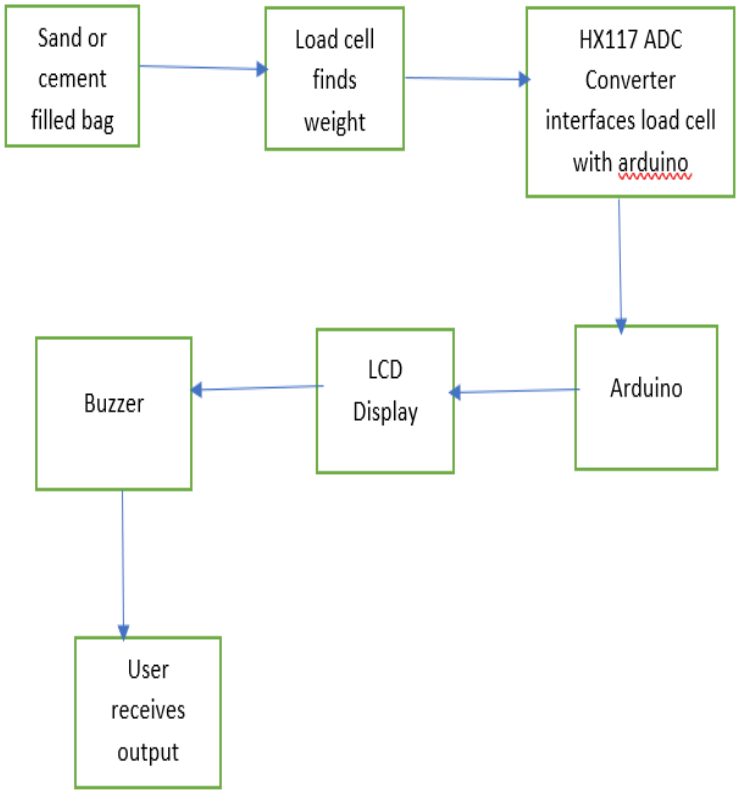
  - Block Diagram

•Block Diagram



As the cement or sand bag is filled with sand the load cell attached to the base of the trolley weighs it and converts the force into electrical outputs. The ADC Converter then amplifies the low electric output of Load cells and then this amplified & digitally converted signal is fed into the Arduino to derive the weight. The weight is then displayed in the LCD Display. If the weight is more than the set amount the buzzer starts buzzing and the user can get notified.

Architecture

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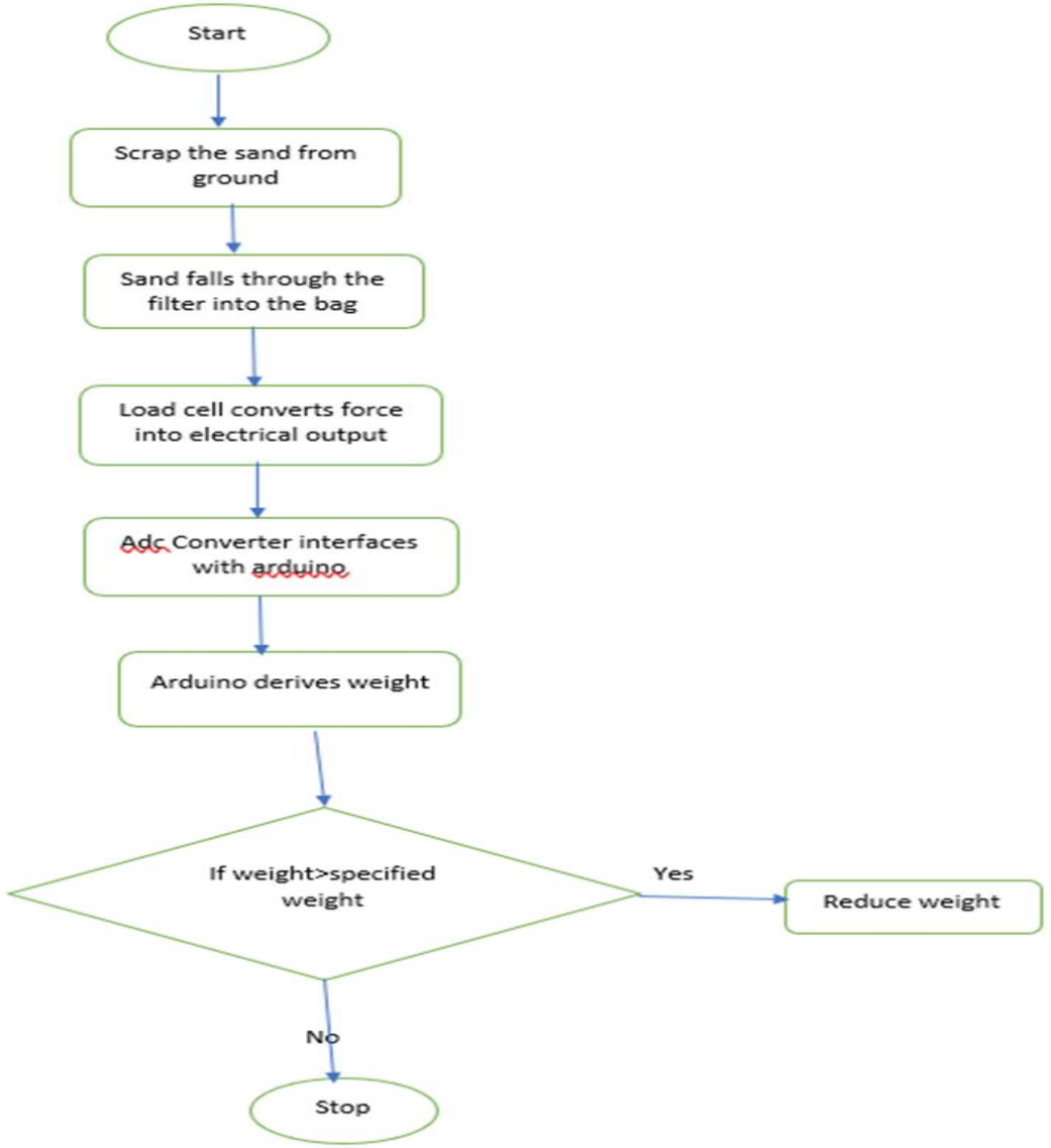
  - Flowchart

•Flowchart



List of Hardware Components

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- Requirements
  - Hardware

- Arduino uno
- Load Cell
- H x 117
- 16 X 2 LCD
- Handle
- Breadboard
- Pipe

Hardware Requirements

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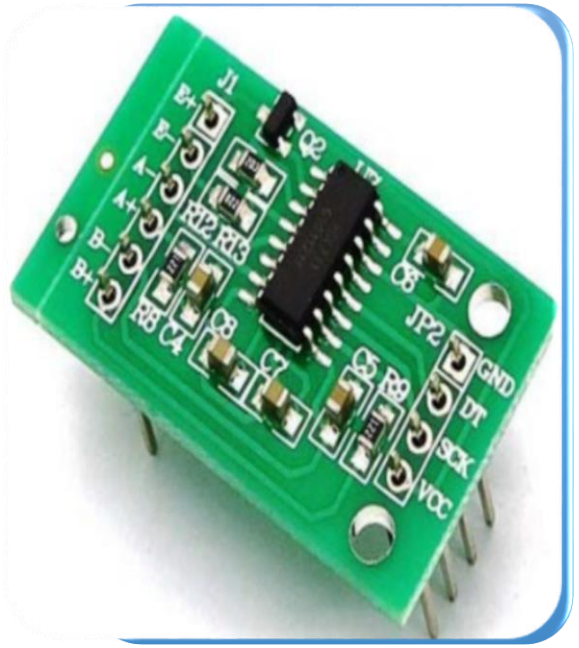

- Arduino
  - Model: Arduino Uno
  - Vendor: Peas Electronics
  - Price: 270Rs
  - Spec: 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal.

- **Description: Arduino Uno** is a microcontroller board based on the ATmega328P . It **has** 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.
- Reference URL: www.arduino.cc

Hardware Requirements

- ❑ Introduction
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- ❑ Requirements
  - ➢ Hardware

- load cell
  - Model: load cell
  - Vendor: Peas Electronics
  - Price: 110Rs
- Spec: Rated Load: 40 Kg. Max
  - Rated Output: 2.0mV/V+/- 5%
  - Zero Balance: +/- 1% Full Scale

- **Description:** Load cell is transducer which transforms force or pressure into electrical output. Magnitude of this electrical output is directly proportion to the force being applied. Load cells have strain gauge, which deforms when pressure is applied on it.
- Reference URL: https://en.wikipedia.org/wiki/Load_cell

Hardware Requirements

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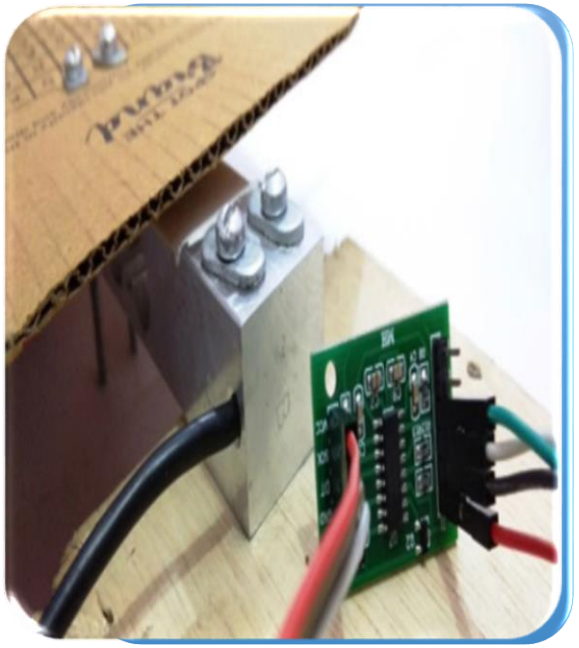

- H x 117 ADC Converter
  - Model: H x 117
  - Vendor: Peas Electronics
  - Price: 150Rs
- Spec: Differential input voltage: ±40mV (Full-scale differential input voltage is ± 40mV)
  - Data accuracy: 24 bit (24 bit A / D converter chip.)

- **Description:** HX711 Weighing Sensor Module has HX711 chip, which is a 24 high precision A/D converter (Analog to digital converter). HX711 has two analog input channels and we can get gain up to128 by programming these channels.

- Reference URL: https://www.digikey.com/products/en/integrated-circuits-ics/data-acquisition-analog-to-digital-converters-adc

Hardware Requirements

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Summary of Components in Tabular form

S.No.	Item	Model	Spec	Vendor	Price In Rs.
1	Arduino	Arduino uno	Digital I/O Pins: 14 (of which 6 provide PWM output) PWM Digital I/O Pins: 6	peas electronics	270
2	load cell	load cell(40 kg)	Rated Load: 40 Kg. Max Rated Output: 2.0mV/V+/- 5% Zero Balance: +/- 1% Full Scale	Peas electronics	110
3	H x 117	H x 117 (load cell amplifier module)	• Differential input voltage: ±40mV (Full-scale differential input voltage is ± 40mV) • Data accuracy: 24 bit (24 bit A / D converter chip.) • Refresh frequency: 10/80 Hz • Operating Voltage: 2.7V to 5VDC	Peas electronics	150
4	Metal handle				200
5	box				16
6	Connecting wires		17 x 2		24
7	Bread board		6 x 8		24
8	bolt,cap,pipe				54
9.	LCD		16 * 2 LCD	Peas Electronics	150
10.	Buzzer		Active Passive Buzzer	Peas Electronics	20
11.	Preset			Peas Electronics	20

List of Software Components

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  - Software

- Arduino IDE
  - Version: ARDUINO 1.8.9
  - Description:The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software.
  - Reference: https://www.arduino.cc/en/main/software

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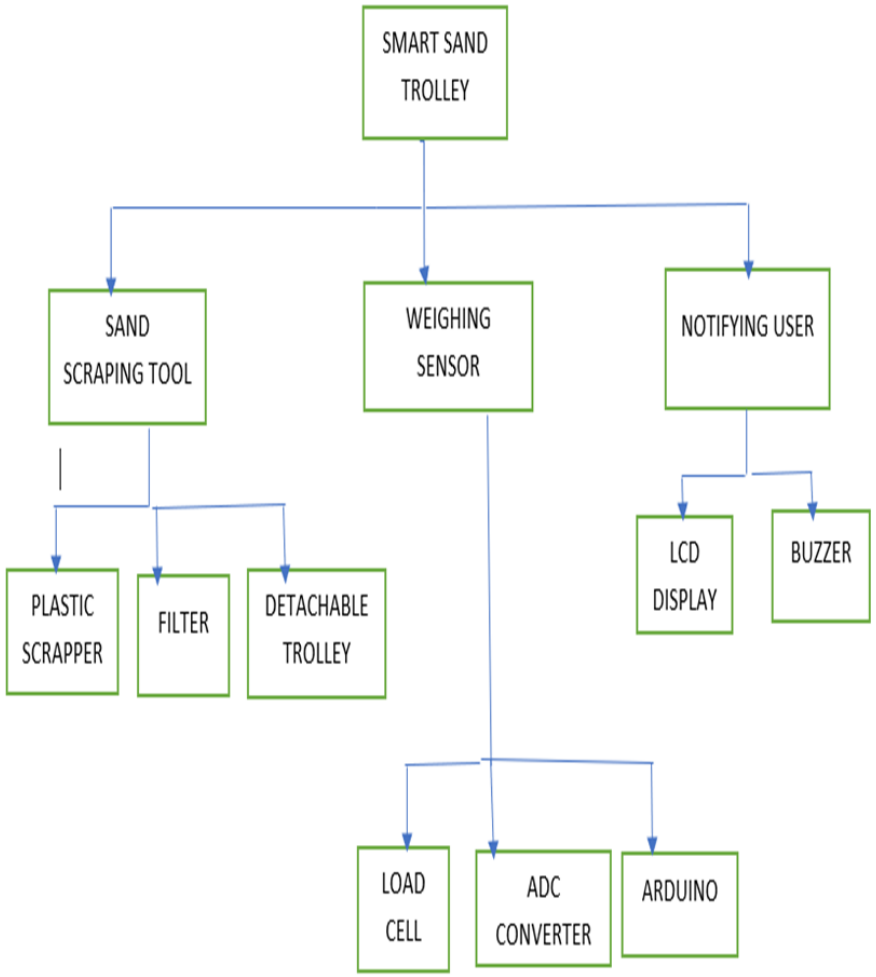
Functional Modules

1. Sand Scraping module
   1. Plastic Scrapper
   2. Filter
   3. Detachable Trolley
2. Weighing module
   1. Load Cell
   2. ADC Converter
   3. Arduino
3. Notifying User module
   1. LCD Display
   2. Buzzer



Schematic Diagram

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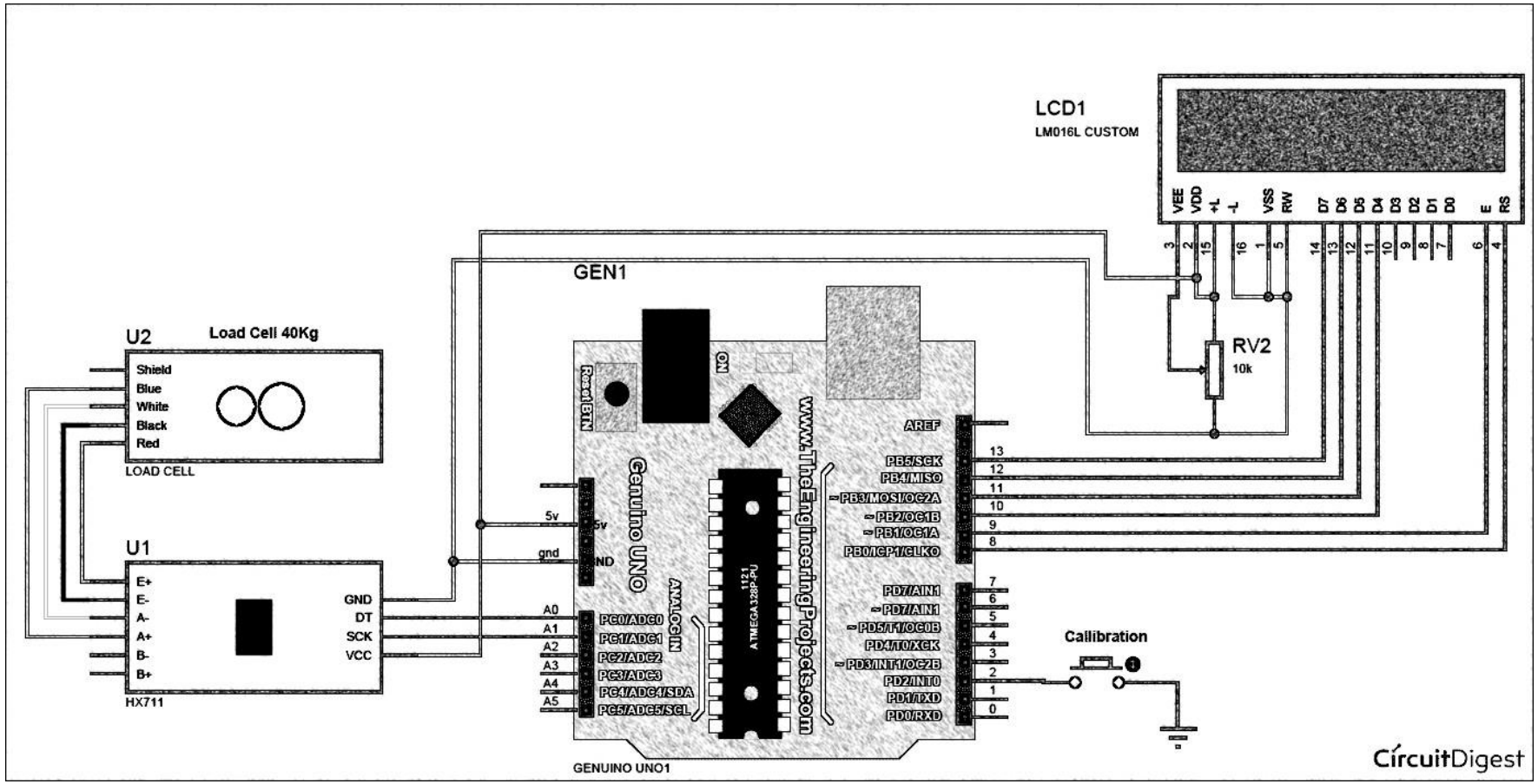

we see our circuit diagram which consists of the Load Cell, Arduino, Adc Converter and LCD Display.

Invention Details

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- Invention Details

- **Objects of Invention**
  - Detachable sand trolley
  - New design of scraping tool
  - Filter attached to scraping tool
  - Weighing facilities in trolley using load cell, adc converter and Arduino.
  - Buzzing notification to user if he exceeds the amount of sand he requires.

- **Summary of invention**

  We have made an efficient and smart sand trolley which can be operated manually without much effort by the masons. It is used to collect exact amount of sand in the sand bag as specified by the user. Also it helps to collect clean sand by separating stone particles from sand. It also notifies the user about the amount of sand collected in bag and starts buzzing if the weight of bag increases the amount specified by the user.

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- **Details of Invention**
  - We have made an efficient detachable sand or cement trolley which can be operated manually without much effort. Usually masons have to scrap sand/cement from ground and carry it on their heads or have to scrap from ground and fill it in a trolley for carrying it and such activities require much effort and are very painful.
  - Scraping sand from ground takes much effort, there are chances of getting injury in head while carry heavy stuffs and the sand or cement scraped is often mixed with stone particles or other debris. So, we have devised a tool to make the masons life easy, also to make the sand free from stones or other particles before it is being put to use and all these can be done with much less effort
  - using our model of sand trolley.
  - Our tool consists of an inclined slope structure with a flat base which can scrap sand or cement from ground and this structure is attached to a detachable trolley in such a way that the inclined surface is movable. A sand bag can be put on the trolley.

Model

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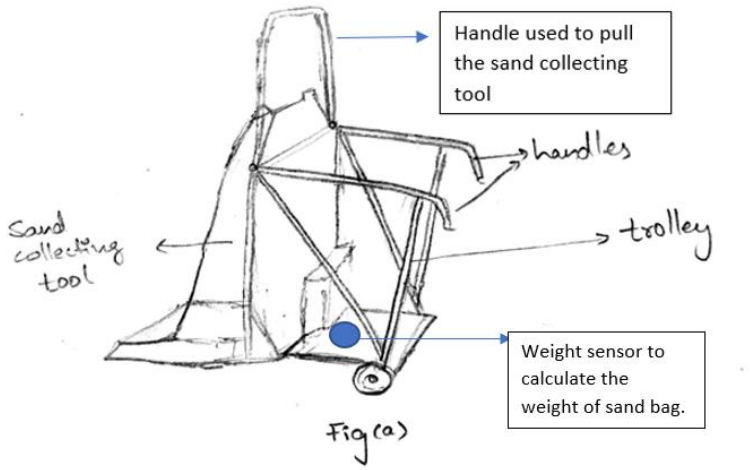
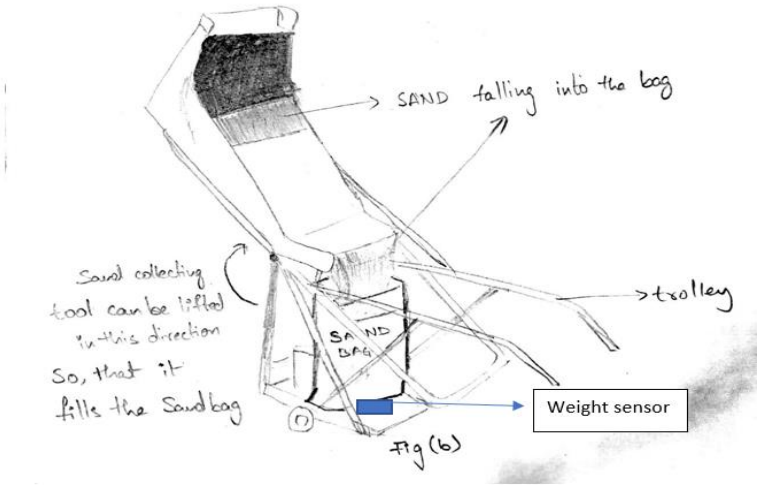
Diagrams:



In **Fig(a)**, we can see the basic structure of Sand Trolley.

In **Fig(b)**, we can see that the sand collecting tool is pulled down and the collected sand is being poured in to the sandbag and the weight is measured using weight sensors.



Working Example 1

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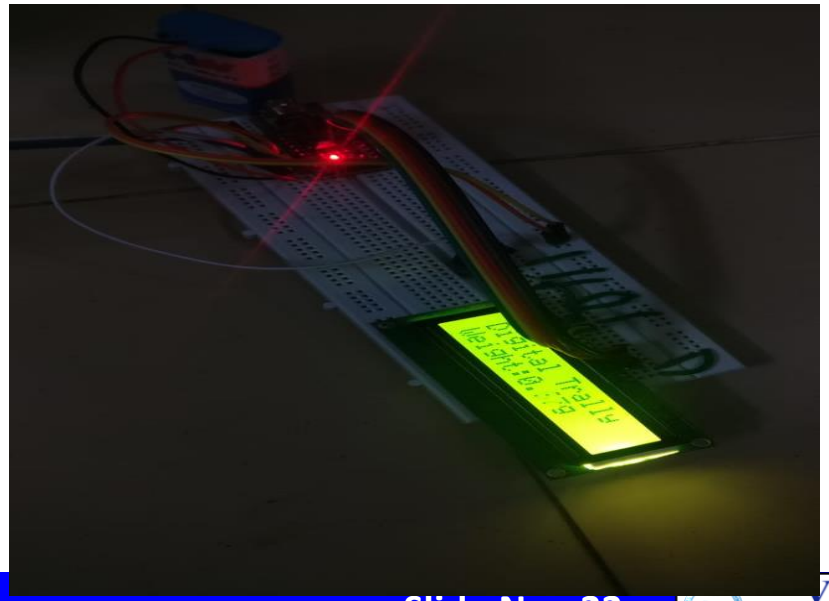
- Working Examples

1a) weight is loaded on trolley

1b) weight display or LCD display



Working Example 2

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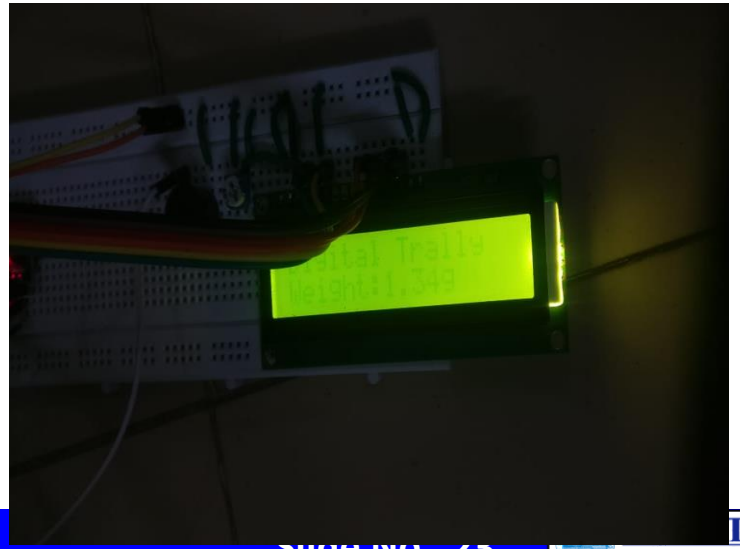
2a) WEIGHT LOADED ON TROLLEY

2B) weight display or LCD display



Implementation

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```
#include <LiquidCrystal.h>
#include <HX711_ADC.h>
#include <EEPROM.h>

HX711_ADC LoadCell(A2, A1);
LiquidCrystal lcd(2, 3, 4, 5, 6, 7);
#define BUZZER A5

#define CAL_MEM 0
long t;

void calibrate(){
  Serial.println("*");
  Serial.println("Start calibration:");
  Serial.println("It is assumed that the mcu was started with no load applied to the load cell.");
  Serial.println("Now, place your known mass on the loadcell,");
  Serial.println("then send the weight of this mass (i.e. 100.0) from serial monitor.");
  float m = 0;
  boolean f = 0;
  while (f == 0) {
    LoadCell.update();
    if (Serial.available() > 0) {
      m = Serial.parseFloat();
      if (m != 0) {
        Serial.print("Known mass is: ");
        Serial.println(m);
        f = 1;
      }
      else {
        Serial.println("Invalid value");
      }
    }
  }
  float c = LoadCell.getData() / m;
  LoadCell.setCalFactor(c);
  Serial.print("Calculated calibration value is: ");
  Serial.print(c);
  EEPROM.put(CAL_MEM, c);
  EEPROM.get(CAL_MEM, c);
  Serial.print("Value ");
  Serial.print(c);
```

Pseudo code

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```
 Serial.println("End calibration");
 Serial.println("For manual edit, send 'c' from serial monitor");
 Serial.println("*");
}
void setup() {
 Serial.begin(9600); delay(10);
 pinMode(BUZZER, OUTPUT);

 lcd.begin(16, 2);
 lcd.print("Digital Trally");
 lcd.setCursor(0, 1);
 lcd.print("Calibrating");

 Serial.println();
 Serial.println("Starting...");
 LoadCell.begin();
 long stabilisingtime = 2000; // tare preciscion can be improved by adding a few seconds of stabilising time
 LoadCell.start(stabilisingtime);
 if (LoadCell.getTareTimeoutFlag()) {
  Serial.println("Tare timeout, check MCU>HX711 wiring and pin designations");
 }
 else {
  LoadCell.setCalFactor(1.0); // user set calibration value (float)
  Serial.println("Startup + tare is complete");
 }
```

Pseudo code

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```
 while (!LoadCell.update());
 float c;
 EEPROM.get(CAL_MEM, c);
 //calibrate();
 LoadCell.setCalFactor(c);
 digitalWrite(BUZZER, HIGH);
 delay(1000);
 digitalWrite(BUZZER, LOW);
}

void loop() {
 LoadCell.update();

 if (millis() > t + 500) {
  lcd.setCursor(0, 1);
  lcd.print("                ");
  float i = LoadCell.getData();
  lcd.setCursor(0, 1);
  lcd.print("Weight:");

  if(i > 1000){
   digitalWrite(BUZZER, !digitalRead(BUZZER));
  }else{
   digitalWrite(BUZZER, 0);
  }
  if(i >= 1000.0){
   i = i / 1000.0;
   lcd.print(i, 2);
   lcd.print("kg");
  }else{
   lcd.print(i, 2);
   lcd.print('g');
  }
  Serial.print("Load_cell output val: ");
  Serial.println(i);
  t = millis();
 }

 if(Serial.available()){
  if(Serial.read() == 'c'){
   calibrate();
  }
 }

 //check if last tare operation is complete
 if (LoadCell.getTareStatus() == true) {
  Serial.println("Tare complete");
 }
}
```

Applicability category

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Society relevant

- Smart Sand trolley will be specially useful in construction sites. All type of construction works can be become easy with the help of this smart trolley.
- With this sand trolley, you can move mulch, compost, debris, dead leaves of garden.
- It can be used for mixing exact amount of powdered ingredients to make any kind of mixtures.

Conclusion

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- Thus our smart sand trolley works efficiently. It is easy to move and scrap sand with this trolley.
- It efficiently filters out the debris from sand and pours clear sand into the bag.
- This trolley continuously shows the weight of the bag as it gets filled with sand.
- As soon as weight increases beyond specified limit buzzer starts buzzing which notifies and alerts the user of the bag weight.
- The product is very cost effective and is affordable.
- It is durable and can be used for construction purposes.

References

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Thank
You