ASSESMENT REPORT ON

Team ID & Title: 19W1027

SMART SAND TROLLEY

Submitted
as part of **CSE3999-Technical Answers for Real World Problems**
by


16BCE0732
Rajdeepa Chakrabarty


16BCE0223
SR Navyasree


16BCE0894
Venkatesh Battula


16BCE0837
M Jawahar Srinath

16BCE0577
P.Bhavana Reddy

To


Dr M Rajasekhara Babu

School of Computer Science and Engineering

VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

March 2019

Index

CHAPTER 1
ABSTRACT

a. Importance of idea

- 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
- Sand or 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.

b. Existing methods

- Present we have wheel barrow which has no facilities of scraping materials from the ground and no measuring capability. It is just used to carry the materials from one place to other.

c. Drawback of existing system

1. Sandor cement scraped is often mixed with stone particles or other debris.we cannot separate stone particles
2. lack of features
3. 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.
4. in efficiency

d. Proposed System

We aim to make 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 by means of a fine mesh which acts as a filter. It should also notify the user about the amount of sand collected in bag by means of weighing sensors and give a warning if the weight of bag increases the amount specified by the user by buzzing.

e. Keywords

sand trolley, smart, filter, exact weight, buzz

f. Implementation issues

The shape of the scraping tool is difficult to make.

g. Results

Sand is easily scraped and collected sand in bad is free of other debris and is of exact amount as required by the user.

CHAPTER 2

OBJECTIVES

1 To make the masons life easy with help of an efficient easy to use sand trolley

2 To make the sand free from stones or other particles before it is being put to use

3 To collect exact amount of ingredients in the bags with the use of measuring sensors.

4 To alert the mason if weight of bag increases the specified amount.

5 To easily carry sand bag using the trolley.

CHAPTER 3

LITERATURE REVIEW

a. National Status

1. WHEEL BARROW

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
- 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

Disadvantages:

- 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

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

- 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.

2. TWO WHEELED SAND TROLLEY

This is a two wheeled sand trolley

Features:

- Robust construction
- Compact design
- Ability to withstand high mechanical stress

Uses:

- Excellent load carrying capacity
- Resistance against corrosion
- Highly durable

Advantages:

- It can carry 100 kgs of weight
- Easily movable

Disadvantages:

- Operator is needed to pickup the sand and cement

b. International Status

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.

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.

The stone carved relief of a man pushing a wheelbarrow was found in the tomb of Shen Fujun in Sichuan province, dated circa 150 AD.

The 5th century Book of Later Han stated that the wife of the once poor and youthful imperial censor Bao Xuan helped him push a lu che back to his village during their feeble wedding ceremony, around 30 BC

Later, during the Red Eyebrows Rebellion (c. 20 AD) against Xin dynasty's Wang Mang (45 BC–23 AD), the official Zhao Xi saved his wife from danger by disguising himself and pushing her along in his lu che barrow, past a group of brigand rebels who questioned him, and allowed him to pass after he convinced them that his wife was terribly ill. The first recorded description of a wheelbarrow appears in Liu Xiang's work Lives of Famous Immortals. Liu describes the invention of the wheelbarrow by the legendary Chinese mythological figure Ko Yu, who builds a "Wooden ox".

In the 1970s, British inventor James Dyson introduced the Ballbarrow, an injection molded plastic wheelbarrow with a spherical ball on the front end instead of a wheel. Compared to a conventional design, the larger surface area of the ball made the wheelbarrow easier to use in soft soil, and more laterally stable with heavy loads on uneven ground.

CHAPTER 4

REQUIREMENTS

a. Hardware Components:

a) Arduino uno

b) load cell (40 kg)

c) H x 117 (load cell amplifier module)

d) 16 X 2 LCD

e) Pre-set

f) buzzer

g) metal handle

h) connecting wire

i) box

j) bread board

k) USB cable

l) Bents

m) T

n) Bolts

o) Pipes

b. Software Components:

a) Arduino IDE

Description of Components:

1. arduino

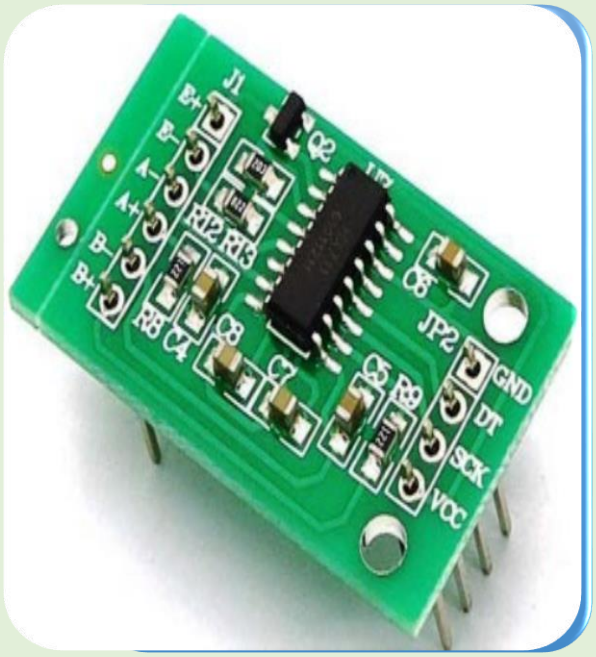


Fig. 1: Title of Component

Name of Item ： Arduino uno

Component Functionality:

Arduino Uno is a microcontroller board based on the ATmega328P . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

Application:

In this project, we have used Arduino to control whole the process. Load cell senses the weight and supplies a electrical analog voltage to HX711 Load Amplifier Module. HX711 is a 24bit ADC, which amplifies and digitally converts the Load cell output. Then this amplified value is fed to the Arduino. Now Arduino calculate the output of HX711 and converts that into the weight values in grams and show it on LCD.

2. load cell

Fig. 1: Title of Component

Name of Item: load cell

Component Functionality:

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. And then strain gauge generates electrical signal on deformation as its effective resistance changes on deformation. A load cell usually consists of four strain gauges in a Wheatstone bridge configuration. Load cell comes in various ranges like 5kg, 10kg, 100kg and more, here we have used Load cell, which can weight upto 40kg.

Application:

A load cell is a type of transducer which is used to convert mechanical force into a measurable electrical output, anything which needs to be weighed probably uses aload cell to do so

In our project Load cell is connected with HX711 Load cell Amplifier using four wires. These four wires are Red, Black, White and Green/Blue

3. H x 117 ADC Converter

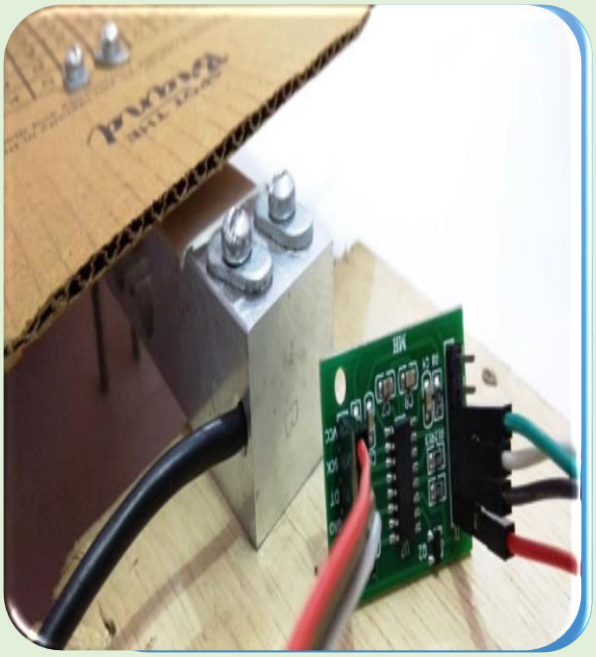


Fig. 1: Title of Component

Name of Item H x 117

Component Functionality:

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. So HX711 module amplifies the low electric output of Load cells and then this amplified & digitally converted signal is fed into the Arduino to derive the weight.

Application:

HX711 module amplifies the low electric output of Load cells and then this amplified & digitally converted signal is fed into the Arduino to derive the weight.

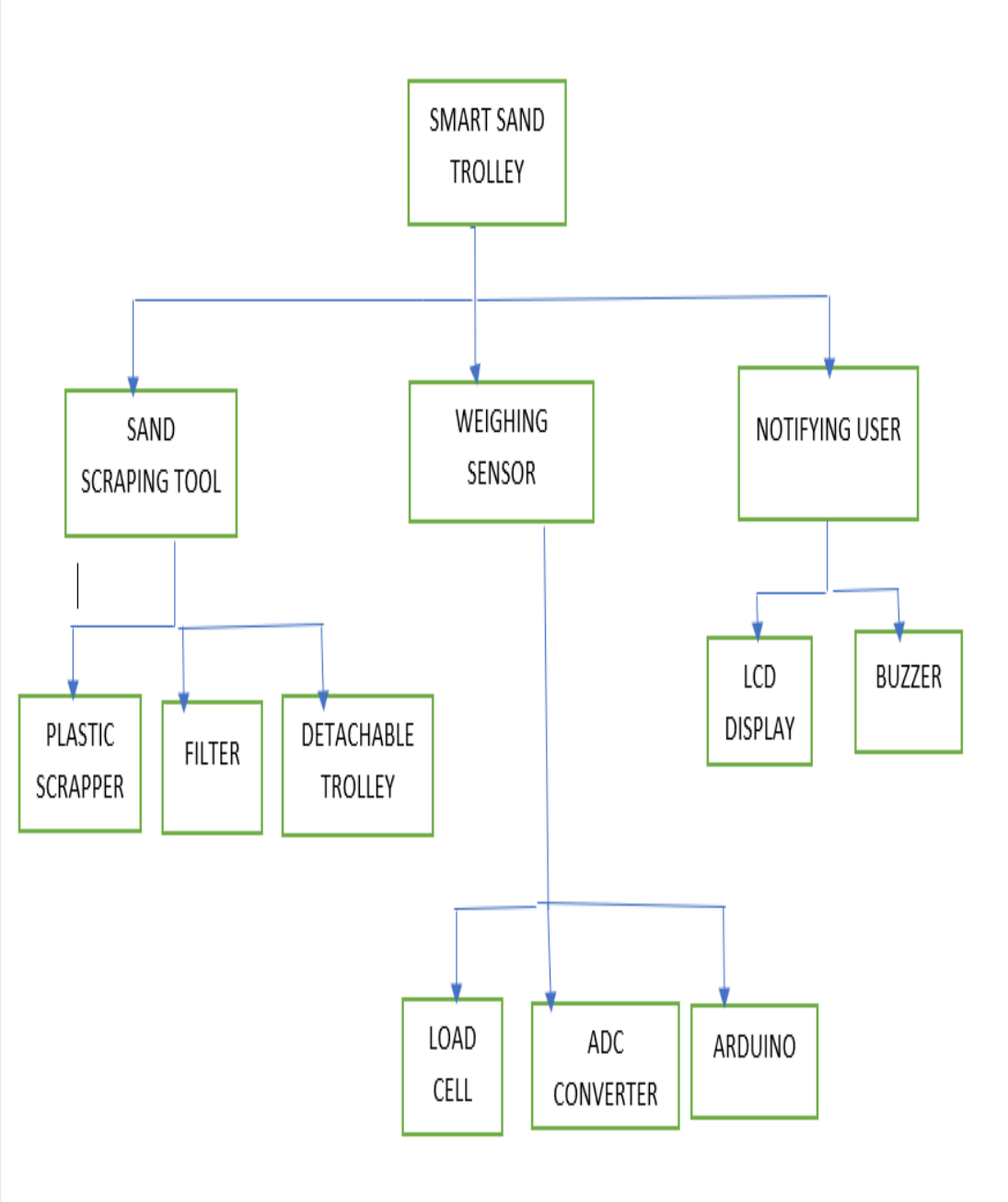
Summary of Components and their costs in Tabular form

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

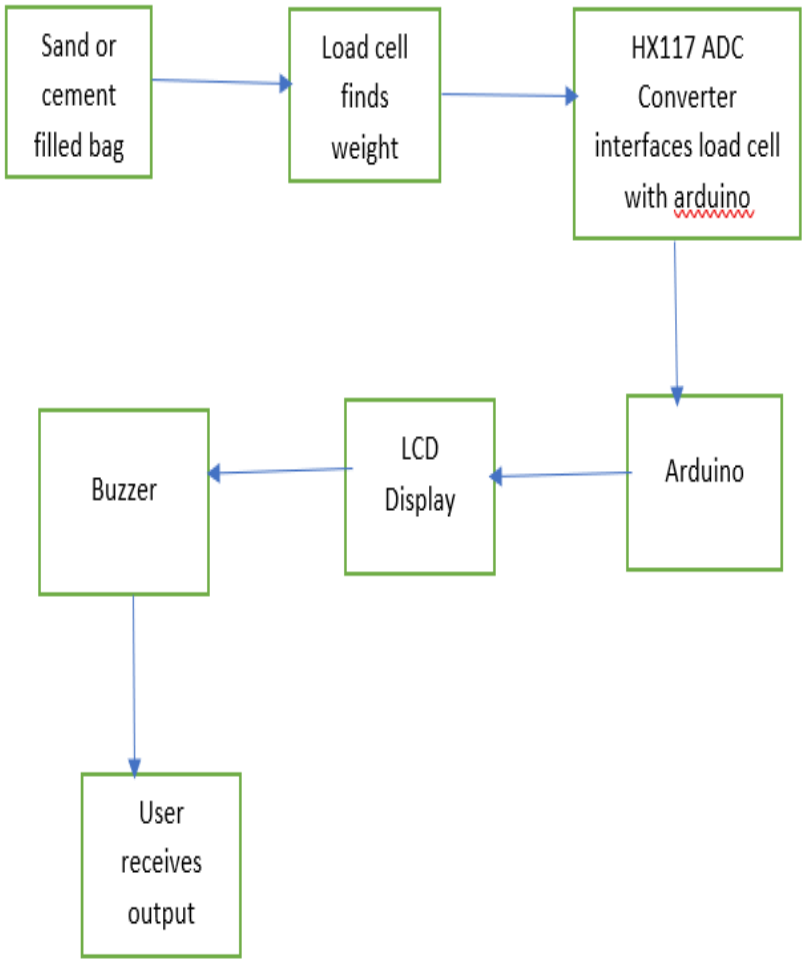
CHAPTER 5

DESIGN

a. ARCHITECTURE

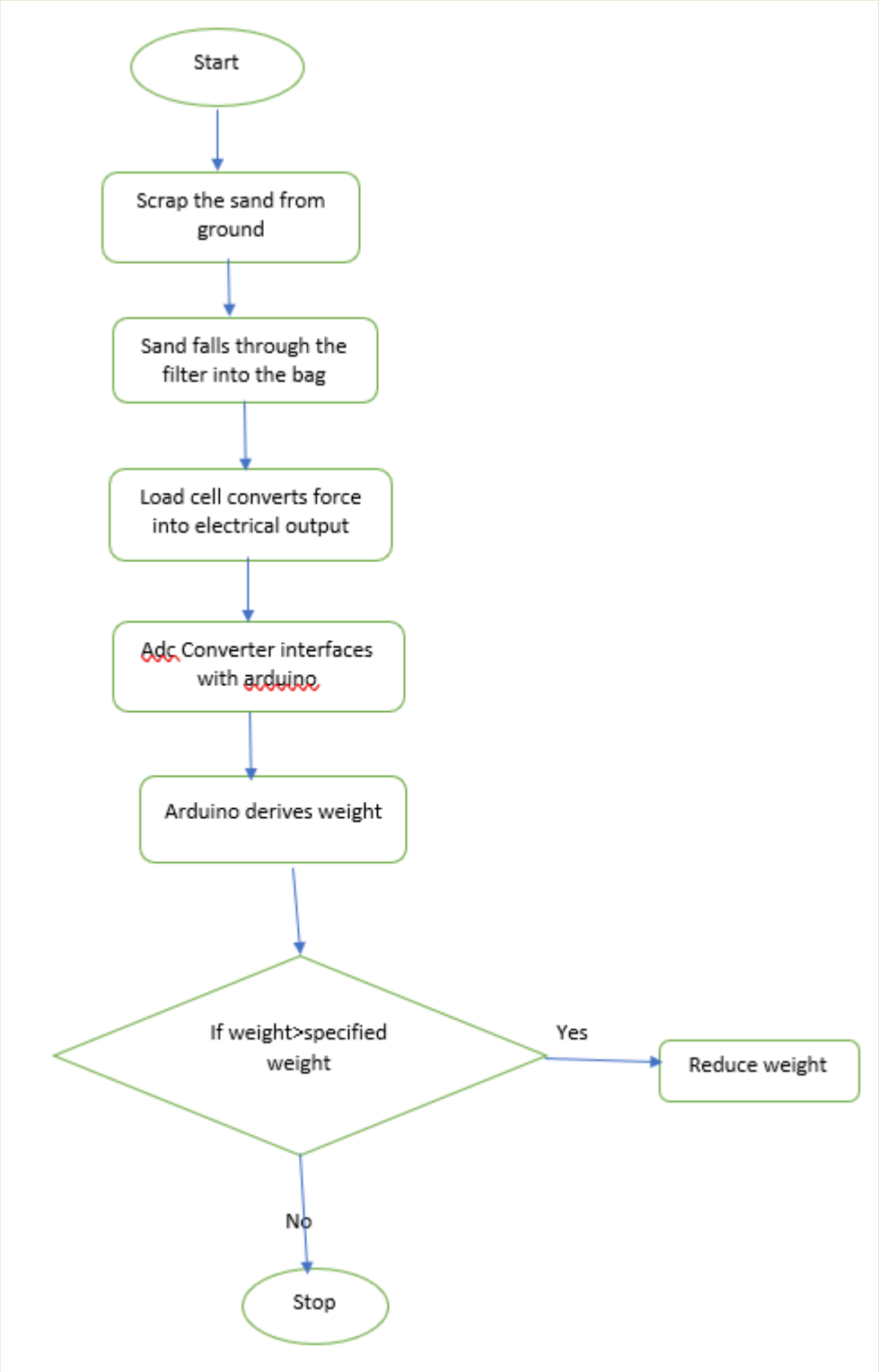


b. BLOCK DIAGRAM



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.

c. FLOW CHART


Start
Scrap the sand from ground
Sand falls through the filter into the bag
Load cell converts force into electrical output
Adc Converter interfaces with arduino
Arduino derives weight
If weight>specified weight
Yes
Reduce weight
No
Stop

CHAPTER 6

INVENTION

a. Objects of Invention

1. Detachable sand trolley
2. New design of scraping tool
3. Filter attached to scraping tool
4. Weighing facilities in trolley using load cell, adc converter and Arduino.
5. Buzzing notification to user if he exceeds the amount of sand he requires.

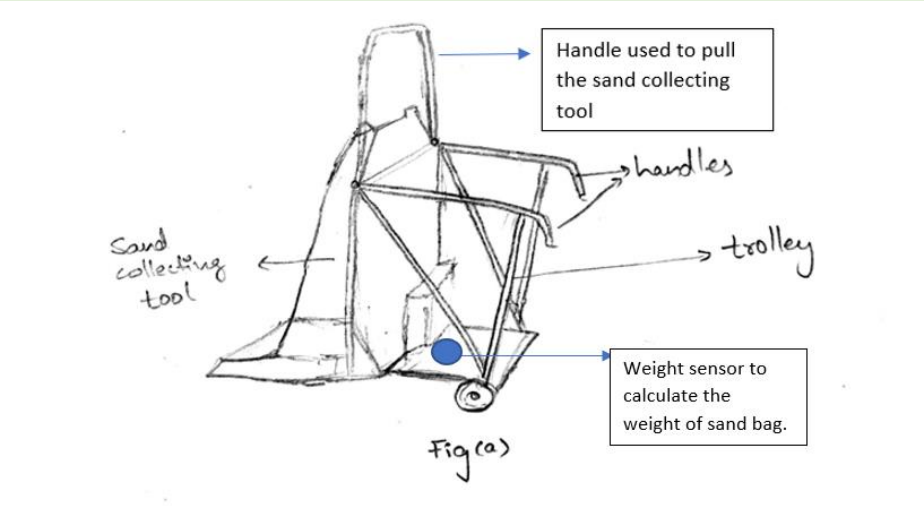
b. Summary of invention

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.

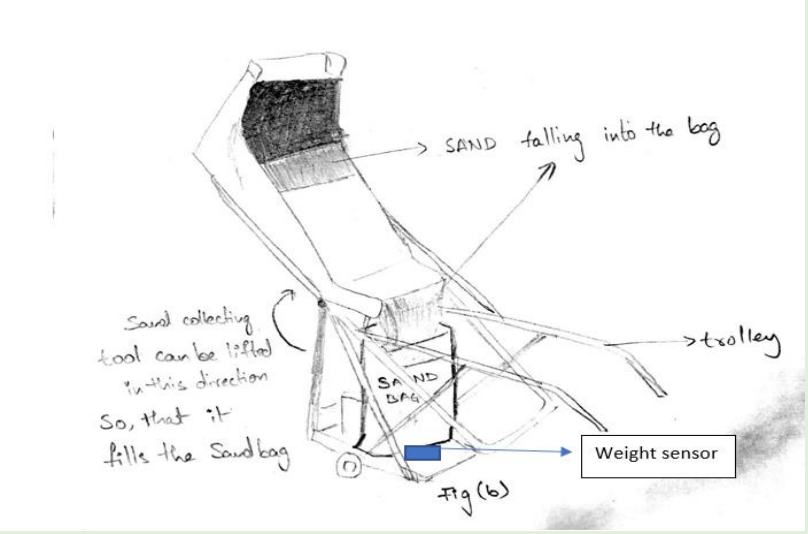
c. Details of invention

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. To scrap sand, a person has to push the trolley from behind using its handles and the flat base of the inclined surface scraps the sand. To fill the sand scraped into the bag, the inclined surface is pulled down and the collected sand drops into the bag. Also, the region through which the sand passes before dropping into the bag has a fine mesh which can separate sand/cement from the other particles and this ensures only sand is collected in the bag. The user can set a fixed amount of weight he wants and as soon as the sand starts falling into the bad our tool starts calculating the weight of sand being filled in the bag and a buzzer starts buzzing if the weight exceeds the specified amount. After filling the bag, the person can detach the trolley from the inclined surface to carry the bag easily on the trolley to the destination.

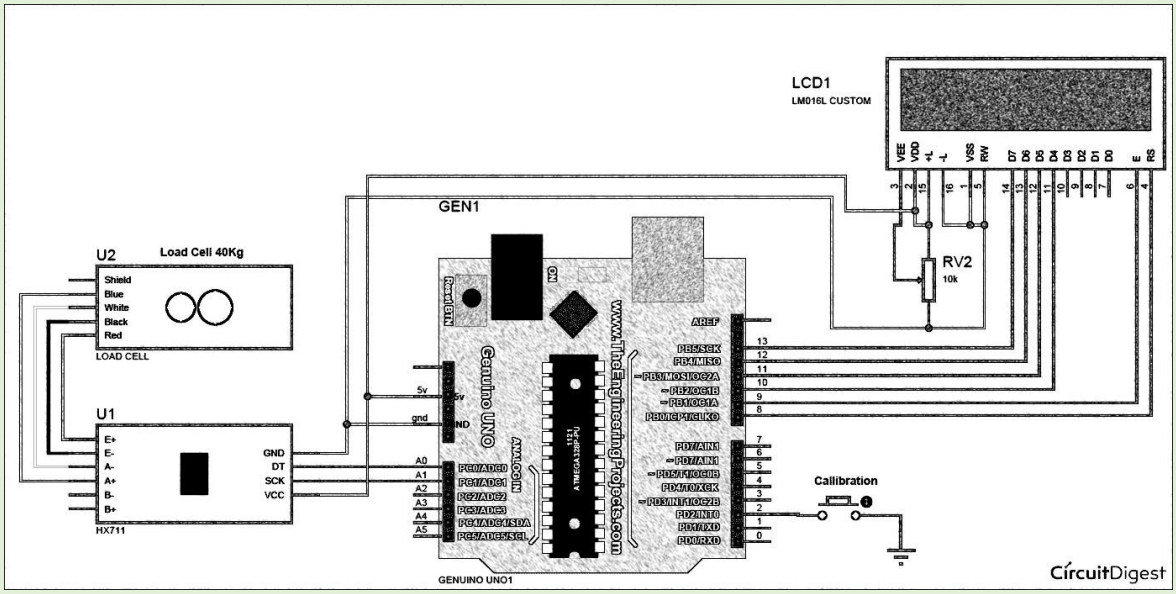
d. Diagrams



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.



In **Fig(c)** we see our circuit diagram which consists of the Load Cell, Arduino, Adc Converter and LCD Display.

e. Details of diagrams

From **fig a** and **fig b** we can see the Sand Trolley mainly consists of two parts i) Sand collecting tool along with a fine mesh acting as a filter. ii) Trolley with a sandbag. The Sand Collecting tool is inclined with a flat base in shape. The role of sand collecting tool is to scrap the sand from ground and pour the sand into the sandbag when it is pulled downwards with the handle. Also, while pouring the filter ensures the stone particles or other debris are retained back and only sand drops into the sandbag. The Trolley with sandbag is detachable and is used to move the Sandbag with ease and it does not make the person strain a lot.
In **fig c** we see the circuit diagram of our project. 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.

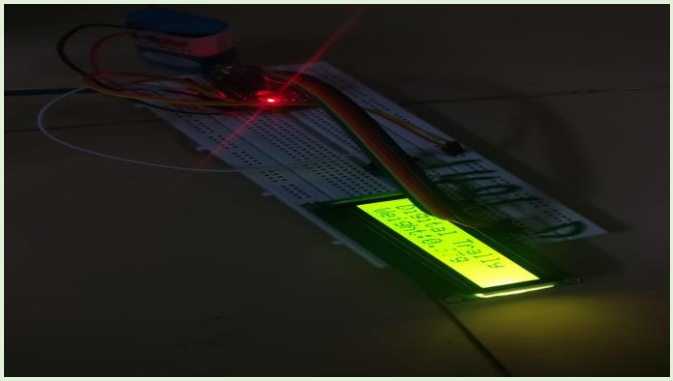
f. Working examples

Working Eg 1:

a.

In this figure a load has been kept on the trolley

b.



Weight is displayed on the LCD display

Working Eg 2:

a.

In this more weight is loaded on the trolley

b.

Weight is displayed on LCD display and buzzer giving notification

g. Observation

In working example 1 the lcd display first gets calibrated and then a weight is placed on the trolley the load cell converts the force into electrical output. The ADC Converter interfaces the load cell with the Arduino which derives the weight. The weight is displayed on the LCD display. The weight displayed is 0.37 g which is less than the specified weight (1000 g) and there is no buzzing notification to the user.

In working example 2 the lcd display first gets calibrated and then a weight is placed on the trolley the load cell converts the force into electrical output. The ADC Converter interfaces the load cell with the Arduino which derives the weight. The weight is displayed on the LCD display. The weight displayed is 1.349 g which is less than the specified weight (1000 g) and there is no buzzing notification to the user.

CHAPTER 7
IMPLEMENTATION

a. Code:

```
#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);
  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");
  }

  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");
  }
}
```

b. Algorithm

1. Calibrate the load cell assuming no weight is placed initially.
2. As weight is being placed on load cell update the value of the load cell and collect the data from it.
3. If the weight is greater than the specified weight then write to the buzzer to buzz.
4. Repeat steps 2 to 3 as weight on load cell keeps on increasing.

CHAPTER 8

APPLICABILITY CATEGORY

Society relevant

- Smart Sand trolley will be specifically 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.

Chapter 9

CONCLUSIONS

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

REFERENCES

1. **https://circuitdigest.com/microcontroller-projects/arduino-weight-measurement-using-load-cell**
2. **https://circuitdigest.com/microcontroller-projects/arduino-uno-adc-tutorial**
3. **https://circuitdigest.com/microcontroller-projects/arduino-uno-adc-tutorial**
4. **https://ijarcce.com/wp-content/uploads/2015/09/IJARCCE-8.pdf**
5. **https://www.instructables.com/id/Smart-Shopping-Cart/**

BRIEF BIOGRAPHY OF EACH TEAM MEMBERS

Team_Member-1 Rajdeepa chakrabarty

Rajdeepa Chakrabarty is a third year Computer Science and Engineering student from VIT, Vellore. She has completed completed her schooling in her hometown Kolkata, West Bengal. I want to pursue my higher education in Data Science. In VIT she has maintained a good cgpa and is a 7th ranker of her branch. She has participated in many hackathons in which she has secured 3rd position in Database Management hackathon, 2nd position in Cisco "Women In Technology" hackathon. She has got certications in Data Structure and Algorithms, Machine Learning and Parallel Programming from Nptel. She was an ex intern at Apt Software Avenues and has done her project on Data Science .She will be interning at Visa Inc. Bangalore in the summer of 2019.

Team_Member-2 SR Navya sree

SR Navys sree is a student at vellore institute of technology.she is currently persuing her btech 3 rd year in computer science.She has completed many courses from coursera and has achieved certificates from some good reputed universities .she also have done 2 research papers in data visualisation and paralle distributed and computing and have also done many good projects in her acedemics.she is also good in some skills like c,c++,java .she is intrested in data analytics ,artificial intelligence and machine learning and want to pursue her carrer in those fields

.

Team_Member-3 venkatesh battula

Venkatesh Battula is hardworking, highly-motivated and ambitious person pursuing Computer Science Engineering in Vellore Institute of Technology,Vellore. His goal is to find a company that he can grow with as he achieve their goals.

Team_Member-4 M jawahar srinath

M Jawahar Srinath is a Upcoming software engineer with experience and management skills and had worked as a Designer in TLA(Tamil Literature Association). And have taken part in Rivera2018 as Volunteer in Publicity and Marketing. Skilled in many programming languages like C, C++, Java, Python. Interested in Web Designing and my Goal is to become an Web Designer in a Top rated Company. Highly Active and self-motivated individual who thinks “Any thing is possible”.

Team_Member-5 Bhavana reddy

Bhavana Reddy is a hardworking engineering student specialised in Computer Science Engineering . She is a kind of person who believes that " action speaks morethan word do "She has completed many Online courses in Coursera with verified certificates . She has published a research paper in IEEE explore .Her short term goal is to get on to the manager role within a 5 years of working experience .Her ultimate goal is not to quit up her career with any reasons

Dr M Rajasekhara Babu

- Dr. M. Rajasekhara Babu is a senior faculty member at School of CSE, VIT University. He had his B.Tech., in Electronics and Communication Engineering(ECE), M.Tech., and Ph.D., in Computer Science and Engineering (CSE). He has published more than 100 papers in Peer Reviewed Journals and International Conferences, produced 8 Ph.D., Students and filed 3 patents. He was instrumental in establishing state-of-art laboratory “Intel Multi-Core Architecture Research Laboratory and Embedded Systems” in collaboration with Intel, India at VIT University and he is fondly introduced with this in most of the forums. He has served in various prestigious positions as Division Leader (TCS &LT), Program Manager, etc., in VIT University. Currently, Dr. RajaBabu is working in the area of Data Analytics and Internet of Things (IoT).