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Smart Trash Segregator using Internet of Things

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ABSTRACT: Rapid increase in volume and types of solid and hazardous waste as a result of continuous economic growth, urbanization and industrialization, is becoming a burgeoning problem for national and local governments to ensure effective and sustainable management of waste. It is estimated that in 2006 the total amount of municipal solid waste generated globally reached 2.02 billion tones, representing a 7% annual increase since 2003 (Global Waste Management Market Report 2007). The segregation, handling, transport and disposal of waste are to be properly managed so as to minimise the risks to the health and safety of patients, the public, and the environment. The economic value of waste is best realized when it is segregated. Currently there is no such system of segregation of dry, wet and metallic wastes at a household level. This paper proposes an Automated Waste Segregator (AWS) which is a cheap, easy to use solution for a segregation system at households, so that it can be sent directly for processing. It is designed to sort the refuse into metallic waste, wet waste and dry waste. The AWS employs parallel resonant impedance sensing mechanism to identify metallic items, and capacitive sensors to distinguish between wet and dry waste. Experimental results show that the segregation of waste into metallic, wet and dry waste has been successfully implemented using the AWS.

KEYWORDS: Trash, IOT

I.INTRODUCTION

As we move towards a more digitalized future, it is directly proportional to increase in urbanization and industrialization. This is the main cause of generation of large amount of waste. As per the report published by World Bank, approximately 1.3 billion tones of municipal waste is generated every year and it is expected to rise to approximately 2.2 billion tons per year by 2025. Due to this waste lies littered in the surrounding, dumped on open lands and this becomes major problem for various types of disease causing bacteria and viruses which is why waste management is of vital importance. Segregation makes it possible to reuse and recycle the waste effectively. So the waste management becomes an important concern for the health and well-being of the society. Presently, the waste segregation is done manually by installing different bins for collecting different type of waste such as wet, dry and metal etc. But this method has lot of discrepancy; one is being the Unawareness of most people towards waste management. Due to lack of proper segregation methods, a large amount of untreated waste is dumped as landfills. So our idea is to make a garbage segregator which can identify the type of waste and put them in different bins accordingly and automatically. Implementing our project at household level will reduce the expenditure on waste disposal, manual effort Required for waste segregation and the waste could be easily being recycled, reused and reduced.

1.1 Internet of things

The Internet of Things (IoT) refers to the use of intelligently connected devices and systems to leverage data gathered by embedded sensors and actuators in machines and other physical objects. IoT is expected to spread rapidly over the coming years and this convergence will unleash a new dimension of services that improve the quality of life of consumers and productivity of enterprises, unlocking an opportunity that the GSMA refers to as the Connected Life'.

For consumers, the IoT has the potential to deliver solutions that dramatically improve energy efficiency, security, health, education and many other aspects of daily life. For enterprises, IoT can underpin solutions that improve decision-making and productivity in manufacturing, retail, agriculture and other sectors.

Machine to Machine (M2M) solutions - a subset of the IoT – already use wireless networks to connect devices to each other and the Internet, with minimal direct human intervention, to deliver services that meet the needs of a wide range of industries. In 2013, M2M connections accounted for 2.8% of global mobile connections (195 million), indicating that the sector is still at a relatively early stage in its development. An evolution of M2M, the IoT represents the coordination of multiple vendors' machines, devices and appliances connected to the Internet through multiple networks.

While the potential impact of the IoT is considerable, a concerted effort is required to move beyond this early stage. In order to optimise the development of the market, a common understanding of the distinct nature of the opportunity is required. To date, mobile operators have identified the following key distinctive features:
1. The Internet of Things can enable the next wave of life-enhancing services across several fundamental sectors of the economy.
2. Meeting the needs of customers may require global distribution models and consistent global services.
3. The Internet of Things presents an opportunity for new commercial models to support mass global deployments.
4. The majority of revenue will arise from the provision of value-added services and mobile operators are building new capabilities to enable these new service areas.
5. Device and application behaviour will place new and varying demands on mobile networks.

II. LITERATURE SURVEY

Automatic waste segregator system is a cocktail of several technological marvels which are discussed as below.

2.1 Related papers and Description

Xian, Kehua. "Internet of Things Online Monitoring System Based on Cloud Computing." International Journal of Online Engineering (I JOE) 13.09 (2017): 123-131.

C.BalasubramaniyanandD.Manivannan. "Iot enabled garbage monitoring system (AQMS) using raspberry Pi." Indian Journal of Science and Technology 9.39 (2016).

Badamasi, Yusuf Abdullahi. "The working principle of an Raspberry PI."Electronics, computer and computation, 11th international conference on.IEEE, (2014).

Hassanalieragh, Moeen, et al. "Health monitoring and management using Internet-of-Things (IoT) sensing with cloud-based processing: Opportunities and challenges."2015 IEEE international conference on services computing (SCC).IEEE, (2015).

Yacchirema, Diana C., et al. "A smart system for sleep monitoring by integrating IoT with big data analytics." IEEE Access 6 (2018): 35988-36001.

PalaghatYaswanthSai, an IoT Based Automated Pollution Monitoring System. International Journal of Advanced Research in Computer and Communication EngineeringVol. 6, Issue 3, March 2017

Somansh Kumar, AshishJasuja,“ Air quality monitoring system based On IoT using Raspberry Pi.”, International Conference on Computing, Communication and Automation (ICCCA), 2017.

AnjaiahGuthi, Implementation of an Efficient Dust bin Monitoring System Using Internet of Things (IoT), International Journal of Advanced Research in Computer and Communication EngineeringVol. 5, Issue 7, July 2016

Rishabh S. Khosla, Pranul S. Chheda, Smith R. Dedhia, Dr.BhaveshPatel, (2016), International Journal on Recent and Innovation Trends in Computing and Communication, Volume: 4 Issue: 1, Shah &Anchor Kutchhi Polytechnic, Mumbai, India

III. PROBLEM DESCRIPTION

In recent times, garbage disposal has become a huge cause for concern in the world. A voluminous amount of waste that is generated is disposed by means which have an adverse effect on the environment. The common method of disposal of the waste is by unplanned and uncontrolled open dumping at the landfill sites. This method is injurious to human health, plant and animal life. This harmful method of waste disposal can generate liquid leachate which contaminate surface and ground waters; can harbour disease vectors which spread harmful diseases; can degrade aesthetic value of the natural environment and it is an unavailing use of land resources.
In India, rag pickers play an important role in the recycling of urban solid waste. Rag pickers and conservancy staff have higher morbidity due to infections of skin, respiratory, gastrointestinal tract and multisystem allergic disorders, in addition to a high prevalence of bites of rodents, dogs and other vermin. Dependency on the rag-pickers can be diminished if segregation

takes place at the source of municipal waste generation. The economic value of the waste generated is not realised unless it is recycled completely.
Several advancements in technology has also allowed the refuse to be processed into useful entities such as Waste to Energy, where the waste can be used to generate synthetic gas (syngas) made up of carbon monoxide and hydrogen. The gas is then burnt to produce electricity and steam; Waste to Fuel, where the waste can be utilized to generate bio fuels. When the waste is segregated into basic streams such as wet, dry and metallic, the waste has a higher potential of recovery, and consequently, recycled and reused. The wet waste fraction is often converted either into compost or methane-gas or both. Compost can replace demand for chemical fertilisers, and biogas can be used as a source of energy. The metallic waste could be reused or recycled. Even though there are large scale industrial waste segregators present, it is always much better to segregate the waste at the source itself. The benefits of doing so are that a higher quality of the material is retained for recycling which means that more value could be recovered from the waste.

3.1 Existing System

The existing system uses PIC microcontroller. It is controlled manually through wireless technology. It doesn't detect any metal automatically. The user must give every command to the system. Automatic waste segregator is designed to sort the waste into three main categories namely; metallic, organic and plastic, thereby making the waste management more effective. Ultrasonic sensors are added for monitoring waste collection process.

Limitations of Existing System:

- Existing models only segregate wet and dry objects.
- Wireless sensor network is used in existing system.
- Wireless range is limited.

3.2 Proposed System

The proposed system uses metal sensor and ultrasonic sensor to separate the metal waste from the waste in the dust bin. The proposed system consists of two doors and opens depending on the wastes. It uses a metal sensor to detect the metal parts in the garbage. The metal sensor contains metal detector which works on the basis principles of electromagnetic induction. Metal detectors contain one or more inductor coils that are used to interact with metallic elements on the ground. A pulsing current is applied to the coil, which then induces a electromagnetic field. When the magnetic field of the coil moves across metal, such as the coin, the field induces eddy currents in the coin. When it detects the metal, the system will open the corresponding door else for the other waste it will open other door. The ultrasonic sensor will detect the presence of the object. LCD display unit displays the status of the segregation process. Servo motor is responsible for motion of the objects. Conveyor belt is used for separation of waste particles. Raspberry PI controls the whole process. Software implementation of Raspberry PI is done through python

3.3 Objective

A trend of significant increase in municipal solid waste generation has been recorded worldwide. This has been found due to over population growth rate, industrialization, urbanization and economic growth which have ultimately resulted in increased solid waste generation. Final destination of solid waste in India is disposal. Most urban solid waste in Indian cities and towns is land filled and dumped. Our Project deals with the most blistering topic i.e. waste segregation. An efficacious management needs to be materialized for better planet to live in. Hence, with our cost effective project proposal, we try to bring in the change. It deals with the minimization of blue-collar method utilization for exclusion of waste into an automated panache. An automation of this style not only saves the manual segregators of the numerous health issues, but also proves to be economical to the nation. Besides, this system utilizes low cost components for the successful segregation of most types of waste. When installed in apartments or small colonies, it proves to be beneficial in sorting the waste at the site of disposal itself. This is the objective of our project.

IV. METHODOLOGY

Here, this project is consist Raspberry PI, Servo Motor, IR Sensor and Ultrasonic Transducer detailed description listed below.

4.1 Arduino

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digitalinput/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, aUSB connection, a power jack, an ICSP header, and a reset button. It contains everything needed tosupport the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DCadapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDIUSB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

4.1.1 Specification

CPU	8bit ATmega328	32bit STM32F051C8T6
SRAM	2 KB	8 KB
FLASH	16 KB	64 KB
EEPROM	1 KB	None
Input Voltage	7-12V	7-24V
Digital I/O Pins	14(6*PWM)	14(6*PWM)
Analog Input Pins	6	6
Clock Speed	16 MHz	48 MHz
Grove Interface	None	4
I2C Interface	1	2
UART Interface	1	2
Touch Key	None	3
Size(L*W)	68.6 * 53.4mm	83.8 x 53.4mm

Table 4.1 Arduino Specification

Table 4.1 shows the Arduino specifications. The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.The board can operate on an external supply of 6 to 20 volts.

If supplied with less than 7V, however, the 5Vpin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. Figure 4.2 depicts the Top view of Arduino Uno.

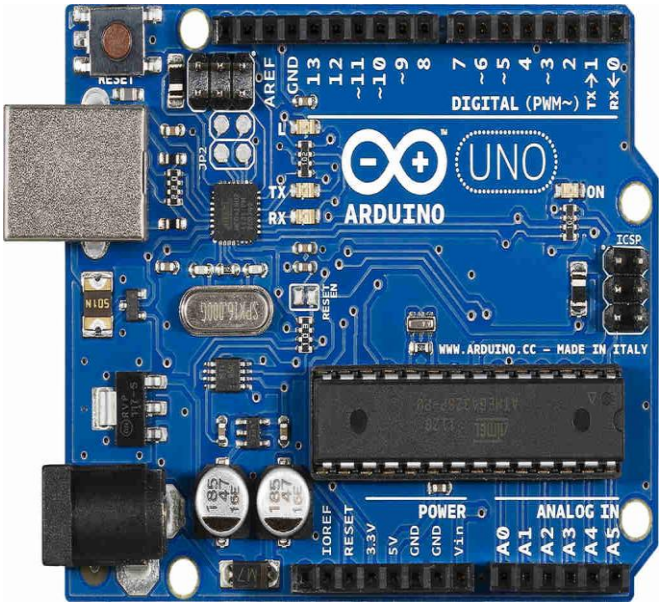

Fig 4.1 Arduino Uno

4.2 IR SENSOR:

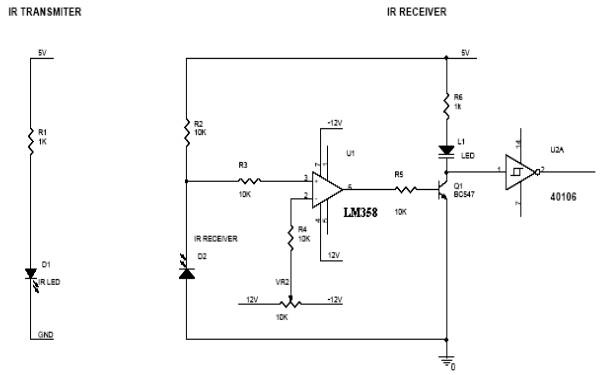

Fig 4.2 IR Sensor Circuit

Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other.

The transmitted signal is given to IR transmitter whenever the signal is high the IR transmitter LED is conducting it passes the IR rays to the receiver. The IR receiver is connected with comparator. The comparator is constructed with LM 358 operational amplifier. In the comparator circuit reference voltage is given to inverting input terminal. The non inverting input terminal is connected IR receiver. Initially when there is no transmitting signal IR transmitter doesn't passes the rays to the receiver. So the comparator non inverting input terminal voltage is higher than inverting input. Now the comparator output is in the range of +12V. This voltage is given to base of the transistor Q1d due to this transistor is conducting. Here the transistor is act as switch so the collector and emitter will short. The output is taken from collector terminal now the output is zero.

When the transmitting signal is given to IR transmitter, IR transmitter passes the rays to receiver depends on the transmitting signal. When IR rays falls on the receiver, the IR receiver is conducting due to that non inverting input voltage is lower than inverting input. Now the comparator output is -12V so the transistor is cutoff region. The output from the collector is +5V. The output signals are given to 40106 IC which is the inverter with buffer. It is used to invert the output either high to low or low to high depend on the interfacing circuit or device.

4.3 ULTRASONIC SENSOR:

Introduction

DYP-ME007(v1 or v2) Ultrasonic Wave Detector Ranging Module Distance Sensor

Details

- Probe Main Technical Parameters
- Center resonant frequency: **40kHz ± 2kHz**
- Static capacitance: **3300P ± 300P**
- Resonant impedance: **120Ω ± 20Ω**
- Frequency bandwidth (-3dB): **Δf-3dB ≥ 2kHz**
- Operation voltage: **300 ~ 500VP-P**
- Limit voltage ≤ **1000VP-P**
- Transmitting beam angle: **6O degrees**
- Operation temperature: **-40 ~ +80 ℃**
- Protection class: **IP65**

Module Performance

- Voltage: **DC5V**;
- Static current: Less than **2mA**;
- Output signal: Electric frequency signal, high level **5V**, low level **0V**;
- Sensor angle: **Not more than 15 degrees**;
- Detection distance: **2cm-500cm** *(Actually up to 2.5m)*
- High precision: **Up to 0.3cm**

Working Principle:

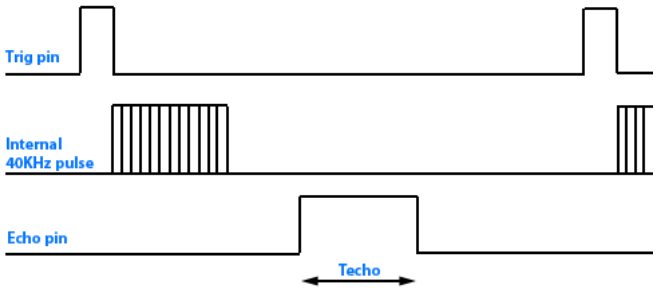

Fig 4.3 Ultrasonic Pulse Diagram

1. Send 12us pulse to pin Trig, to start measurement
2. The ultra sonic module will automatically send eight 40khz square waves, automatically detects whether there is a reflect signal
3. When there is an reflect signal back, the Echo pin will output a high level, the duration of the high-level signal is the time (Techo) from untral sonic launch to return.

As a result, the Measured distance = (Techo * (Sound speed (340M/S))) / 2;

Fig 4.4 Ultrasonic Model

4.4 SERVO MOTOR:

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system. Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.

Mechanism:

A servomotor is a closed loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft. The motor is paired with some type of encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops.

The very simplest servomotors use position-only sensing via a potentiometer and bang-bang control of their motor; the motor always rotates at full speed (or is stopped). This type of servomotor is not widely used in industrial motion control, but it forms the basis of the simple and cheap servosused for radio-controlled models.

More sophisticated servomotors use optical rotary encoders to measure the speed of the output shaft and a variable-speed drive to control the motor speed. Both of these enhancements, usually in combination with a PID control algorithm, allow the servomotor to be brought to its commanded position more quickly and more precisely, with less overshooting.

4.5 ALCOHOL SENSOR:

Fig 4.5 Alcohol Sensor

In this illustration we will going to wire the NPN Inductive Proximity Sensor to detect metal or any metal objects, this device also can be used as a metal detector screening when people walking through the entrance to find metal objects. This metal sensor are inductive sensors. Which means that it induces current when metal is near to it. This sensor is a non-contact electronic sensor that is used detect positions of a metal objects. The sensing sensing range depend on the type of metal being detected. Ferrous Metal, such as iron and steel, allow for a longer sensing range, while nonferrous metal objects such as aluminum, copper, can reduce the sensing range by 60 percent. Since the output of an induction sensor has two possible states, an inductive sensor sometimes referred to as an inductive proximity switch.

This sensor consist an induction loop, electric current generates a magnetic field, which collapses generating a current that falls toward zero from its initial trans when the input electricity stops.

The inductance of the loop changes according to the material inside it and since metals are much more effective conductors that other materials the presence of metal increases the current flowing through the loop. This change can be detected by sensing circuitry which signal pass true to some other device whenever metal is detected.

This device is commonly used in traffic lights, car washes, manufacturing machinery, automated industrial machinery, elevators and building automatons this device is mostly used because can adopt in a rugged and dirt environment.

Weight Sensor:

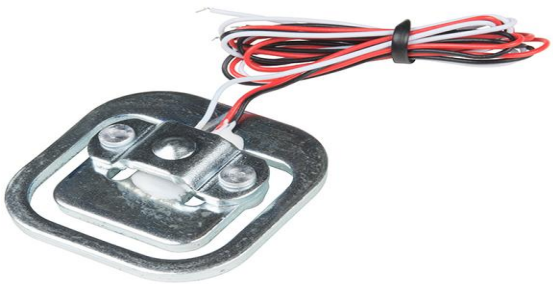

Fig 4.6 Weight Sensor

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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.

Now the electrical signals generated by Load cell is in few millivolts, so they need to be further amplify by some amplifier and hence HX711 Weighing Sensor comes into picture. HX711 Weighing Sensor Module has HX711 chip, which is a 24 high precision A/D converter (Analogue 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.

Load cell is connected with HX711 Load cell Amplifier using four wires. These four wires are Red, Black, White and Green/Blue. There may be slight variation in colors of wires from module to module. Below the connection details and diagram:

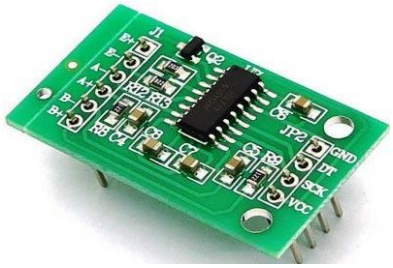

Fig 4.7 Load Cell Connection

- RED Wire is connected to E+
- BLACK Wire is connected to E-
- WHITE Wire is connected to A-
- GREEN Wire is connected to A+

Fixing Load Cell with Platform and Base:

This step is optional and you can directly put the weights on the Load cell without Platform and can simply clamp it without fixing it with any base, but it's better to attach a platform for putting the large things on it and fix it on a Base so that it stand still. So here we need to make a frame or platform for putting the things for weight measurement. A base is also required to fix the load cell over it by using nuts and bolts. Here we have used a hard cardboard for the frame for placing things over it and a wooden board as Base. Now do the connections as shown in the circuit diagram and you are ready to go.

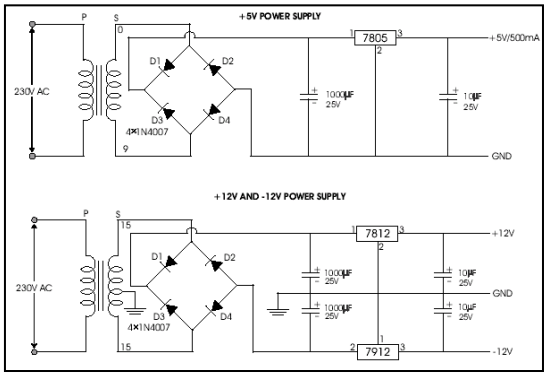

Fig 4.8 Circuit diagram (Power supply)

Working of this Arduino Weight Measurement project is easy. Before going into details, first we have to calibrate this system for measuring correct weight. When user will power it up then system will automatically start calibrating. And if user wants to calibrate it manually then press the push button. We have created a function *void calibrate()* for calibration purpose, check the code below.

For calibration, wait for LCD indication for putting 100 gram over the load cell as shown in below picture. When LCD will show *"put 100g"* then put the 100g weight over the load cell and wait. After some seconds calibration process will be finished. After calibration user may put any weight (max 40kg) over the load cell and can get the value over LCD in grams. A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground.

The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts.

- For ICs, microcontroller, LCD --------- 5 volts
- For alarm circuit, op-amp, relay circuits ---------- 12 volts

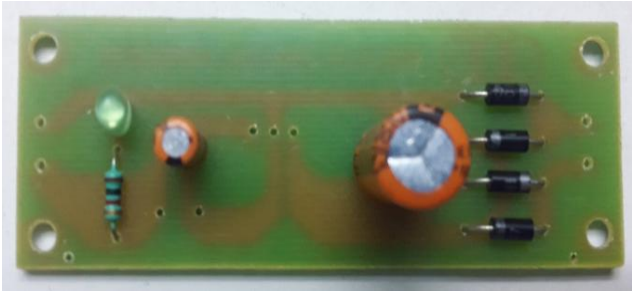

Fig 4.9 Power supply Assembled Board

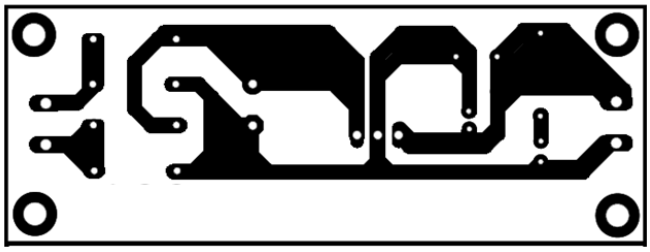

Fig 4.10 Power supply PCB Diagram

V. EXPERIMENTATION

Microcontroller plays a vital role in this project. The only device can monitor and control the whole process what we proposed. The PIC controller has lot of futures when comparing with the basic controller commonly known as 8051. The controller has internal Pulse width generation, analog to digital converter module and Flash memory.

L293D is the type of full bridge motor driver. The driver is used to control the high current DC motor. Controller voltage is not enough to drive high power load so, the driver is used. The motor is connected with the phase changing rod. When the timer is match with the set time then controller activates the motor according to the condition. The motor direction whether forward or reverse, it's all depends upon the last status received by microcontroller.

Here, Keypad is used to set the activation/deactivation time. As per electricity board the phase changing time is not fixed. Monthly once it will be revised. The changing time is announced to the Team. Then they are activate the phase according the instruction. Due, to this problem we are interfacing keypad with the project. Reprogramming the chip is taking an extra time to update. User friendly keypad is easing the process.

Liquid Crystal Display is used to monitor ongoing process. The display is not mentionable use apart from time entering process. Controller has the control of the liquid crystal display. The current time is visible in the LCD module.

DS1307 is the type of serial interface real time clock. The integration chip internally constructed with some of special function register which is used to monitor the current time. We can easily modify the internal register to set current time or read time. Relay driver is used to cut-off the main power. Without shutting down the power phase changing may end the higher risk. The relay model is deactivate the power when controller trying to change the phase. It will be activated by controller within seconds after phase changing.

ESP8266 is a low cost Wi-Fi chip used to connect the embedded kit with online. In this process last switch activation status displayed in relevant active webpage. User can monitor and control the phase changing status at any time or

anywhere in the world. The only need is internet connectivity. Both user and hardware need proper internet connectivity to possible the process. Otherwise, it doesn't affect controller's performance its work offline also.

5.1 CIRCUIT DIAGRAM:

For Metal Proximity Sensor:

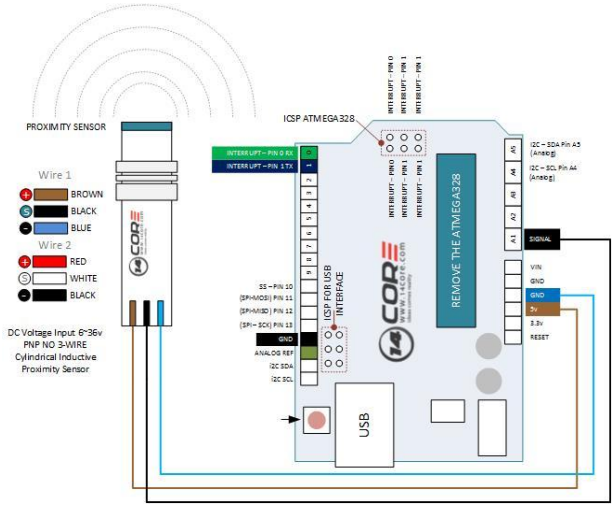

Fig 5.1 Metal Proximity

For Load Cell Weight Censor:

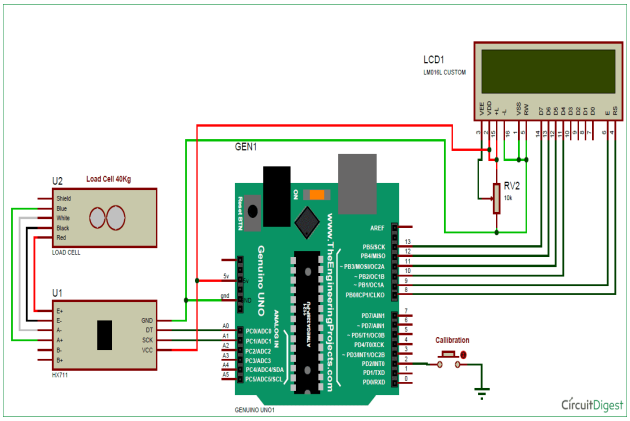

Fig 5.2 Load Cell Weight Censor

VI. RESULTS & DISCUSSIONS

6.1 RESULTS:

When the on time matched with the current RTC time, the main power is tripped and phase changing mechanism is activated. The Process not completed until either the motor touch the limit switch or certain time delay. If the Limit switch pressed means the phase changing process is assumed as working properly and the data will uploaded to the server. Otherwise Phase changing failure notification will be uploaded to the web server. After the process controller activates the Power and wait for reaching off time.

6.2 FUTURE SCOPE:

The proposed system is fully automated and standalone system. The only need user must enter the ON/OFF Time to activate the process. This model has work with both Online and Offline mode. Using online mode the project status will be monitored through web server. User can control the Phase changing by passing an argument. But in offline model the model

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is useless when phase changing is not successes, It's just activates buzzer itself. This is the main problem and need improve future. We need to interface a GSM module with that kit. Whenever the controller goes to offline mode the GSM module will be activated. When phase changing failure detected, the controller make call or send warning message to authorities.

6.3 ADVANTAGES:

- **Speed –** High speed communication 1us per instruction execution for controller.
- **Accuracy** - Automation systems are more accurate and consistent than their human counterparts.
- **Production** - Work cells create more because they perform applications with more accuracy, speed and tirelessness.
- **Reliability –** The system can work 24 hours a day, seven days a week without stopping or tiring.
- **Flexibility –** The system can be reprogrammable and possible to apply additional sensor parameters.

6.4 LIMITATIONS:

1. Need proper maintenance.
2. Shot circuit.
3. Electrical shocks.
4. Continuous data may hang controller module.
5. Need proper network courage.

VII. CONCLUSION

phase changing process is assumed as working properly Monitoring the fullness of bins through the use of sensors, it is possible to achieve a more efficient system than the current existing. Our idea of "Smart waste management system", mainly concentrates on Monitoring the waste management, providing a smart technology for waste system, avoiding human intervention, reducing human time and effort and which results in healthy and waste ridden environment.
The proposed idea can be implemented for smart cities where the residents would be busy enough with their hectic schedule and would not have enough time for managing waste. The bins can be implemented in a city if desired where there would be a large bin that can have the capacity to accumulate the waste of solid type. The cost could be distributed among the residents leading to cheaper service provision.

VIII.FUTURE SCOPE

There are several future works and improvements for the proposed system,
1. Change the system of user's authentication and atomic lock of bins which would help in securing the bin from any kind of damage or theft.
2. Concept of green-points that would encourage the involvement of the residents or the end users making the idea successful and helping to achieve joined efforts for the waste management and hence fulfilling the idea of Swachch Bharath.
3. Having a case study or data analytics on the type and times the waste is collected on the type of days or season making the bin filling predictable and removing the dependency on electronic components and fixing the coordinates.

REFERENCES

[1]. Bajaj JS. Urban Solid Waste Management in India. New Delhi: Planning Commission Government of India; 1995.
[2]. Daniel Hoornweg, et al. What a Waste: A Global Review of Solid Waste Management. Washington, DC: Urban Development & Local Government Unit World Bank, No.15; Mar 2012.
[3]. Shuchi Gupta, Krishna Mohan, Raj Kumar Prasad, et al. Solid Waste Management In India: Options and Opportunities. In Resource, Conservation and Opportunities. Nov 1996; 24(2): 137p.
[4]. Pushpa MK, et al. Microcontroller Based Automatic Waste Segregator. International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering (IJIREEICE). May 2015; 3(5).
[5]. Nishigandha Kothari. Waste to Wealth. New Delhi: NSWAI; Jul 2013.
[6]. Sakai S, Sawell SE, Chandler AJ. World Trends in Municipal Solid Waste Management. Environmental Preservation Centre, Kyoto University, Japan. 1996; 16: 341p.
[7]. Claudine Capel. Innovations in Waste. Waste Management World. Mar 2010; 11(2).
[8]. Claudine Capel. Waste Sorting: A Look at the Separation and Sorting Techniques in Today's European Market. WasteManagement-World. Jul 2008; 9(4).
[9]. Sathish M, et al. E-bin. Advance in Electronic and Electric Engineering (AEEE). 2013; 3.