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Development of Squander Tracker framework using IOT concepts

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Abstract: **- The proposed Development of Squander Tracker aims at smart way of screening garbage using sensors and IOT concepts. Squander Tracker will quantify and compute the range of garbage accumulated in container and this data will be sent to cloud server with location details. Squander Tracker is also integrated with automatic lid technology to lock the bin once filled, which reduces overfill and spill of garbage in an**
d around container. IOT technology will play a vital role in transmitting real-time data to cloud. Through cloud Server data will be processed and sent it to concern Authorities to take essential action along with unique password to unlock the Squander Tracker. The data can be tracked through mobile app also. This inkling will primarily reduce the garbage accumulation and protect society from harmful diseases, secondly will cut down the transport cost of garbage collecting vehicles as the garbage collection will be carried out in a planned manner.

Keywords: Automated Lid system, IOT, Motion sensor, Range detector, Squander management

I. INTRODUCTION

At present Garbage management has become an integral task of both urban and environmental bodies across the world. Couple of decades before the garbage management was simple as there was limited amount of non-decomposable materials. Now with the advancement in technology and considerable rise in the use of non-recyclable materials like plastic, e-waste, fiber, Styrofoam, medical disposables etc. It has become a tedious and highly challenging task for recycling the garbage.

From below Table [1] it can be analyzed that approximately 260 tons of waste is generated per day.

Table 1: Sources of waste generation

SN	Sources of waste generation	Quantity(TPD)
1.	Non Slum Households	160.7
2.	Slum Households	10.3
3.	Shops and establishment, schools, temples etc	20.5
4.	Hotels ,Choultries etc	26.7
5.	Market ,Vegetable shops & meat shops	28.8
6.	Hospitals & Clinics	5.9
7.	Industries	1.4
8.	Others	5.1
	Total	**259.4**

This paper proposes a self-intelligent IOT based Squander tracker. This real-time system will lessen the garbage segregation and ensure society from unsafe infections, also will cut down the transport cost of garbage gathering vehicles
Squander Tracker is designed using Broadcom BCM2835 based Raspberry Pi 3(RPI 3) Model B. Related sensors and interfaces are connected through RPI3 and the available Wi-Fi interface on RPI 3 is utilized to interact with the cloud. Each interface in design is validated as an individual module and tuned to match required specification. Once individual interface passes the required validation criteria, modules are integrated to form Squander Tracker system.

II. SYSTEM ARCHITECTURE

Squander tracker architecture is shown in below Figure [1]. The entire operation can be divided into three section:

Fig 1: Architectural view of Squander Tracker

A. Squander Tracker/ Smart Bin:

Squander Tracker is designed using Broadcom BCM2835 based Raspberry Pi 3(RPI 3) Model B. Related sensors and interfaces are connected through RPI3 and the available Wi-Fi interface on RPI 3 is utilized to interact with the cloud.

B. Cloud Platform:

Data resides in the cloud for the ease of accessibility, scalability and modifications. The data is hosted in the cloud will be accessed by mobile App or by concerned authority.

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C. Garbage collection vehicle connected to cloud via Mobile APP:

Location of the Squander tracker, unique device ID, status of the bin and password is hosted to the cloud. The concerned authority of the Garbage collection vehicle can track the status of the bin and collect the garbage only when it is full.

III. SYSTEM HARDWARE DESCRIPTION

Detailed block diagram of squander tracker is described in Figure [2]. In the Garbage bin at bottom side of lid Ultrasonic sensor, RPI controller and on board WIFI module are placed. On top of the lid PIR Sensor, LCD module, Tri-color LED's and Keypad is fixed. The Lid of the Garbage tracker is controlled by Servo Motor. GPS and WIFI on board will help in locating the Garbage bin location and send status to the cloud platform. The entire system requires 5(V) power supply and max of 2(A) of current.

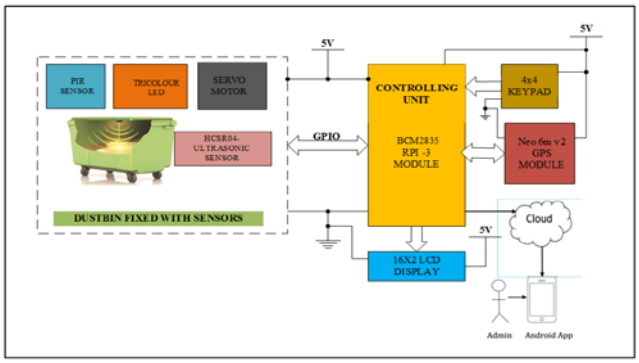

Fig 2: Detailed Block Diagram of Squander Tracker Framework

Below are the building blocks of Squander Tracker:

a) PIR Sensor-HCSR501
b) Ultrasonic Sensor –HCSR04
c) 16X2 LCD Display
d) 4X4 Matrix Keypad
e) Raspberry PI 3 Module B
f) Servo Motor – Tower Pro SG909g
g) GPS Module –Questar G702-001UB

A. PIR Sensor-HCSR501:

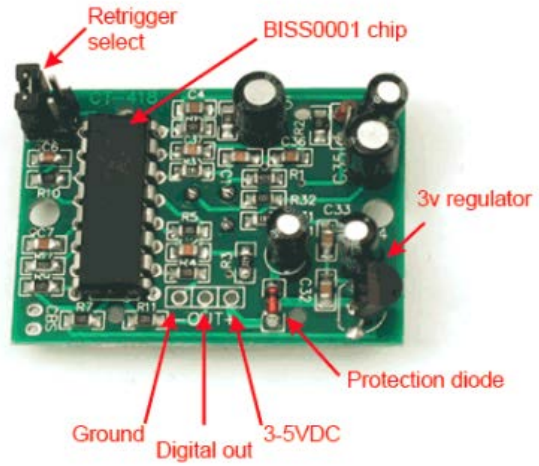

Fig 3: PIR Sensor

Living beings whose temperature of the body is greater than 0ºC will radiates heat in infrared radiation form from their body. This signals are invisible to human eye. The word passive indicates that it is not able to produce or emit any energy for detection. They detect the IR radiation reflected by living being. This sensor operates on 5(V). There are two potentiometers on PIR motion sensors board for Sensitivity and Time delay adjustment. It is possible to make PIR more sensitive or Non Sensitive Enough. The maximum sensitivity can be achieved up to 6 meters. Time Delay Adjustment potentiometer is used to adjust the time period. The Clockwise Movement of the potentiometer makes PIR more Sensitive.

B. Ultrasonic Sensor: HCSR04

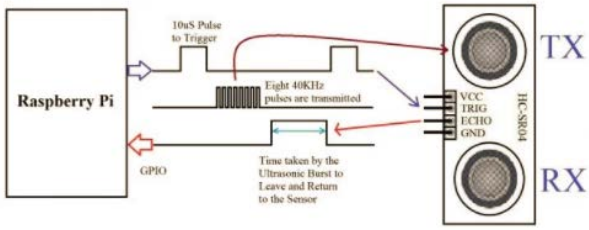

Fig 4: Ultrasonic Sensor working

HC-SR04 is used as ultrasonic sensor for calculating distance. Ultrasonic sensor working is based on sonar technology from which distance to an object is measured. It gives an excellent accuracy in measuring distance. Operation requires 5(V) input voltage and requires less than 2(mA).It can detect range between 2(cm) to 4.5(m).The sensor sends high frequency sound pulse signal through trigger pin for duration of 10(us). We know that the sound speed in air is 341(m/s). Ultrasonic sensor utilizes start pulse and stop pulse difference of the sound signal triggered to measure the range. Mathematical formula associated with it is given by:

Distance (cm) = [((Start pulse- Stop pulse) x 34100) ÷ (2)]

C. 16x2 LCD Display:

LCD is an electronic module used for displaying alphanumeric characters on a two pieced transparent glass called substrate. Liquid Crystal Display (LCD) has 16X 2 columns and rows respectively. It has 3 control signals, Register-Select (R/S), Read or Write (R/W) and Enable (E) and 8 lines of Address/Data pins and Command Register gives instruction twill instruct the LCD for executing the required task and Data Register will store required data that has to be displayed on LCD.

D. 4X4 Matrix Keypad:

4X4 Matrix Keypad will have 8 terminals of which four will be row matrix and other four will be columns matrix. The both matrix will be driven out from 16 buttons in the module. The 16 alphanumeric digits present in the module surface will be the 16 buttons arranged in the form of matrix as shown below:

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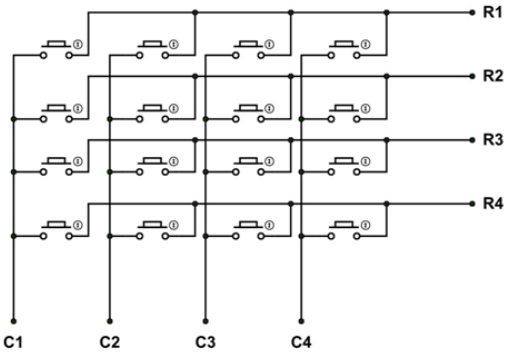

Fig 5: Internal block diagram of Keypad

E. Servo Motor-Tower Pro SG909g:

Servo motor, electrical gadget will push or spindle an object more accurately to the required position. Any application which needs to rotate an object at particular angle or range, then servo motor will be right potion to utilize. Servo motor uses servo mechanism, which has a control unit along with DC/AC motor. If the servo engine is DC fueled then it is called DC servo engine, and if it utilizes AC powered engine then it is called AC servo engine. High torque engines will be of light weight and are of small bundles in size. They are being utilized in numerous applications like Toy Vehicles, Robotics and Door control in buildings.

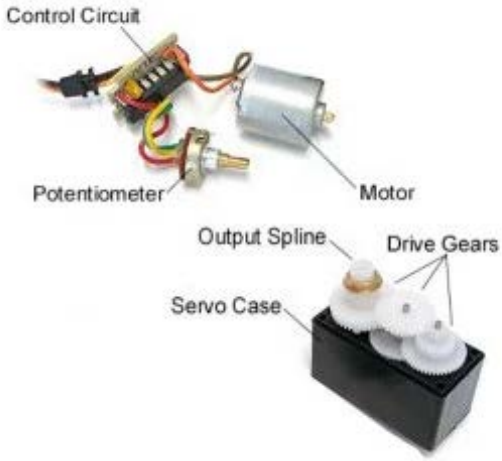

Fig 6: Servo Motor internal block diagram

F. GPS Module – G702-001UB:

To determine the latitude and longitude on any part of the Earth, GPS is used. GPS stands for Global Positioning Satellite. It also gives UTC (Universal Time Coordinated) time along with location data. GPS device receives Coordinate data from satellite for every second along with time and date information. GPS sends data in NMEA format.

G.Raspberry PI 3 module:

The Raspberry Pi is a single-board computers with a very small form factor. Raspberry Pi has ARM Cortex based BCM2837 processor with 1.2GHz processor clock rate. This is two times the clock rate of RAM and is roughly 10 times the CPU performance of original

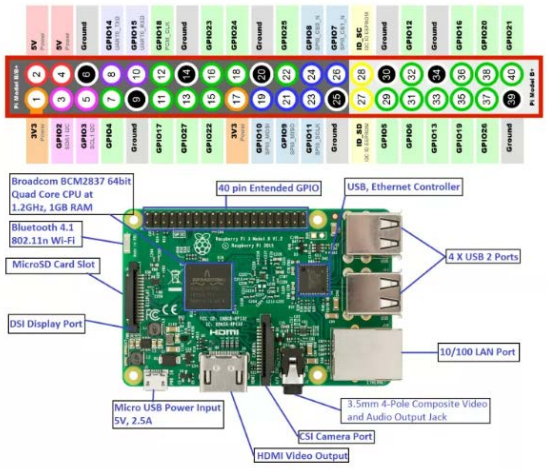

Fig 7: Raspberry PI 3 Module

RPI module. RPI has 1GByte of RAM and 4Gbytes of on-board eMMC flash. RPI module requires 5(V), 2.5(A) adapter for powering up the module. Raspberry Pi has 40 GPIO, but all GPIO cannot be used for programming. Only GPIO pins of 2 to 27 can be used for General Purpose IO configuration. These GPIO are also used as special function pins like SPI, I2C and UART Pins. Each GPIO pin is capable of delivering maximum of 15mA. RPI module offers 5V and 3.3V on module.

IV. WORKING PRINCIPLE

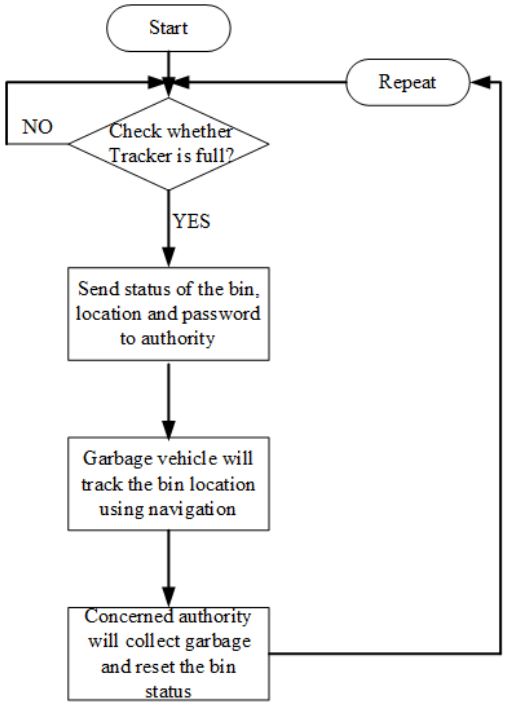

Fig 8: Flow chart of data transmission to cloud

Smart waste bin is powered through either USB Adapter/ Rechargeable solar panel based battery. In this scenario, Development board is powered up with 12V adapter. Here the word controller refers to Raspberry PI, Broadcom based BCM2835 controller.

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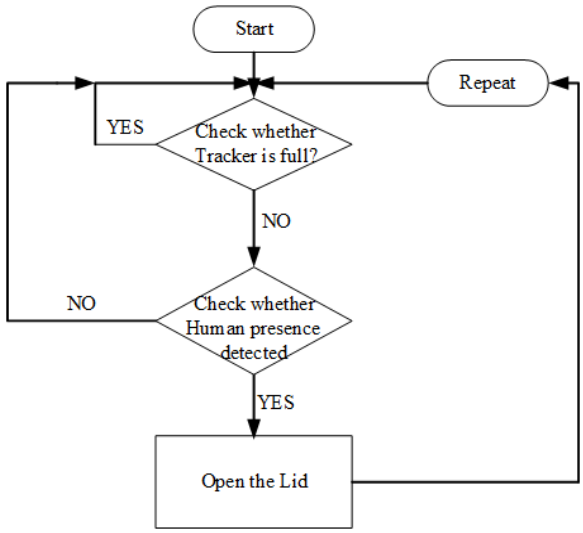

Fig 9: Flow chart of Squander Tracker Lid control

Flow chart in Figure [8] and [9], depicts the flow of Squander Tracker implementation. PIR sensor is made use to detect the human presence. The sensor interrupts the controller to send PWM pulses as input to Servo Motor. This further drives the Servo Motor enabling the lid to open. The condition on which the lid will be opened to dump the garbage will be subject to the deposit in the bin. If the bin reaches the threshold of 100% the lid shall remain in the closed state. Ultrasonic sensor embedded in the bin inputs the data of the bin occupancy to the controller which in turn is displayed on the LCD. The occupancy of the bin is also to be displayed using LED as below.

a) Occupancy Level: 0 – 50% is indicated in Green
b) Occupancy Level: 50% - 90% is indicated in Orange
c) Occupancy Level: 90% - 100% is indicated in Red

Once the bin reaches an occupancy level of 100% the lid is shut and will be opened by keying a four digit pin using 4x4 key pad available. The same is preprogrammed in the controller.

V. RESULT

Below Figure [10] shows the implementation of Squander Tracker. Table [2] Functionality checklist defines how the interface is integrated for Functionality Testing

Python Platform, Adafruit Libraries, Raspbian 2.1 OS are used for validation platform

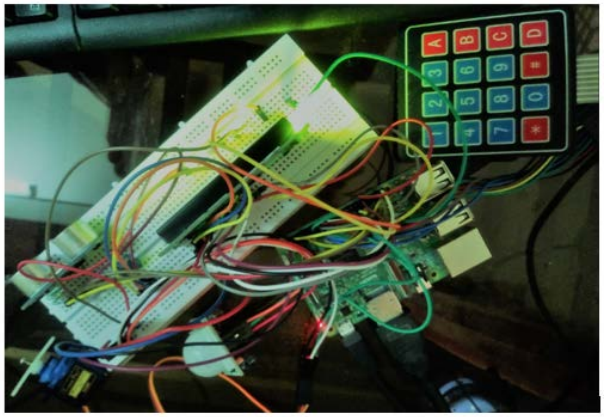

Fig 10: Implementation of Squander Tracker using Raspberry PI module

The project objective was to implement the idea of Squander Tracker using Raspberry PI module and check the functionality of each Interface.

Table 2: Checklist of Functionality Testing

Interface	Specification	Pass Criteria	Fail Criteria	Remarks
LED	Check tri colour LED	Pass		Checked with PIR and Ultrasonic sensor
PIR sensor	Motion Detection	Pass		Integrated with LED function and Ultrasonic sensor
Ultrasonic Sensor	Range Detection	Pass		Checked with PIR and LCD display
Servo motor	90 Degree rotation	Pass		
LCD Display	Display Range	Pass		Integrated with Ultrasonic Sensor
4x4 Keypad	Lock open check	Pass		Checked for Key pressed
GPS	Latitude and Longitude Data	Pass		Tested on final Integration
WiFi Module	Detection and data to cloud	Pass		ThingSpeak IOT hub was Used
App/Cloud interface	Range data on Cloud website	Pass		ThingSpeak IOT Platform was Used

A. Servo Motor Interface

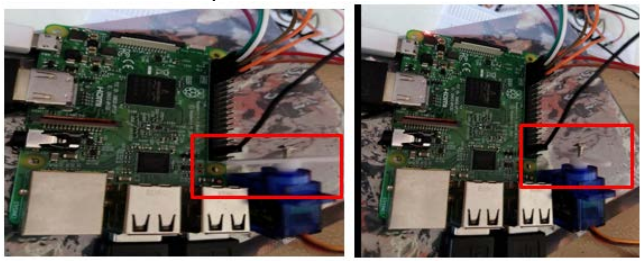

Fig 11: Servo Motor with 0º and 90º rotation

B. LED, PIR Sensor and Ultrasonic Sensor

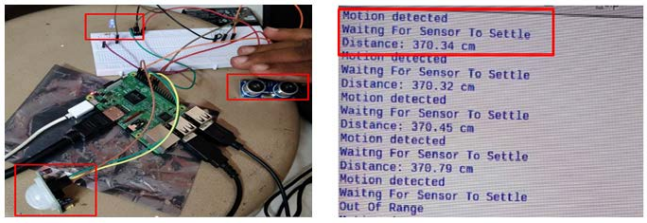

Fig 12: PIR Sensor, Ultrasonic Sensor and LED output on motion sense detection

C. Ultrasonic Sensor with LCD Display

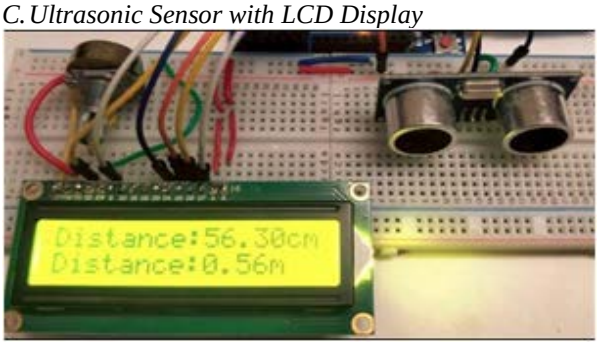

Fig 14: Ultrasonic Sensor output on LCD

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D.Keypad with LCD display

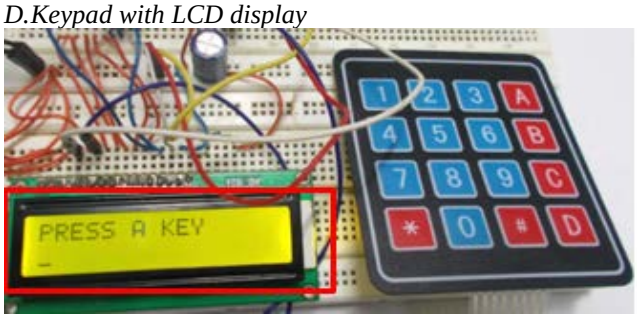

Fig 15: Keypad output on LCD

E. IOT ThingSpeak Cloud Output Data

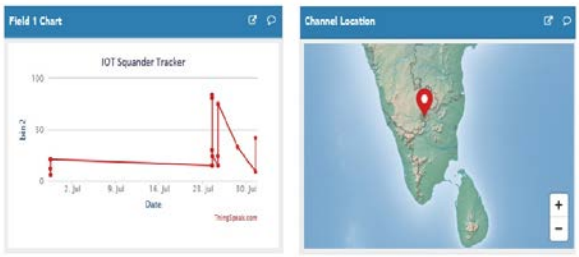

Fig 16: Squander Tracker Data on ThingSpeak cloud

VI. CONCLUSION

The proposed Development of Squander Tracker as described screens garbage using sensors and upload data to cloud using IOT concepts. The data can be tracked through android app also. Thus, this hunch will primarily reduce the garbage accumulation and protect society from harmful diseases, secondly will cut down the fuel cost of garbage collecting vehicle as there is no need go frequently to collect garbage of fewer filled container.

REFERENCES

[1] M.A.Al Mamun, M.A.Hannan, A.Hussain, and H.Basri, "Theoretical model and implementation of a real time intelligent bin status monitoring system using rule based decision algorithms," Expert Syst. Appl., vol. 48, pp. 76–88, 2016. (References) https://www.researchgate.net/publication/286034884/download

[2] "Internet of Things Applications, Challenges and related future Technologies" World Scientific News 67(2) (2017) 126-148 EISSN 2392-2192

[3] Raspberry Pi Compute module Development Kit Technical Reference Manual, https://www.raspberrypi.org/documentation/hardware/computemodule/datasheets/rpi_DATA_CM_1p0.pdf

[4] Ultrasonic Ranging Module HC - SR04 Technical Datasheet, https://www.mouser.com/ds/2/813/HCSR04-1022824.pdf

[5] PIR Motion Module HC-SR501 Technical Datasheet, https://www.mpja.com/download/31227sc.pdf

[6] QueStar GPS Module Technical Datasheet, https://4.imimg.com/data4/VX/PR/MY-5859485/gps-module.pdf

[7] ThingSpeak IOT Tutorials and Technical Reference, https://thingspeak.com/pages/how_to