

MINI PROJECT REPORT

On

"Smart garbage overflow control system"

By

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Third Year Mini Project

UNDER THE GUIDANCE OF

Prof. Kalyani Pampattiwar

SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF
BACHELOR OF ENGINEERING

In

Computer Engineering



DEPARTMENT OF COMPUTER ENGINEERING

SIES GRADUATE SCHOOL OF TECHNOLOGY

NERUL, NAVI MUMBAI – 400706

ACADEMIC YEAR

2018 – 2019

CERTIFICATE

This is to certify that this is a bonafide record of Mini Project titled “**Smart garbage overflow control system**” carried out by the following students of third year in Computer Engineering.

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We have examined this report as per University requirements at SIES Graduate School of Technology, Nerul (E), Navi Mumbai on _____.

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ACKNOWLEDGEMENT

The success and final outcome of this project required a lot of guidance and assistance from many people and we are extremely privileged to have got this all along the completion of my project. All that we have done is only due to such supervision and assistance and we would not forget to thank them. We owe our deep gratitude to our internal project guide **Mrs Kalyani Pampattiwar**, who took keen interest on our project work and guided us all along, till the completion of our project work by providing all the necessary information for developing a good system. We respect and thank **Dr. Rizwana Shaikh, Mrs.Masooda Modak and Dr. Vikram Patil**, for providing an opportunity to do the project work and giving us all support and guidance which made us complete the project duly. We are extremely thankful to her for providing such a nice support and guidance.

We are thankful to and fortunate enough to get constant encouragement, support and guidance from all Teaching staffs of Computer Engineering which helped us in successfully completing our project work. Also, we would like to extend our sincere esteems to all staff in laboratory for their timely support.

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ABSTRACT

A developing overpopulated country like India has many challenges when it comes to garbage collection in housing societies and other public places. Garbage bins remain uncollected for long periods of time putting the lives of people who live or work near these places at risk, in an event that there is Cholera outbreak especially during the rainy season. This happens because the general garbage collection squad does not have a system that monitors the garbage levels or estimates which area has high wastage output that results in faster filling of dustbins in that area. In order to avoid such a situation, this project proposes the design and implementation of a Smart Garbage and Waste Overflow Management System using GPS and GSM technology for providing real time information on the status of the garbage bins, i.e. when they are nearly filled so that appropriate action can be carried out. The system notifies the people in charge of garbage collection by telling them where the bin is exactly located. Again, after the message has been sent, the vehicle is provided with the route that is shortest to the bins that need to be collected. This development will ultimately save a lot of time especially when the garbage collector does not have to go and check the level of garbage in the bin manually. Besides, it will prevent the overflow of garbage due to the fact that garbage will be collected on time. This is not a system that replaces the entire collection system that used to collect the garbage over the years rather it would just add few vehicles that would be used only when nearby bins overflow. This report contains the proposed system its methodology, design and results from our tests.

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CHAPTER 1

INTRODUCTION

This garbage collection problem is a problem that is rising and will hit our society soon, with cities that will no longer be able to sustain itself drowned in plastic bags and unclean roads, this situation although unlikely may happen if the current garbage collection system is unable to keep up with the speed that the society generates it. This problem has high potential and has been sought after by many huge organizations to think of a way that is sustainable and with minimum expenses.

From our perspective we found a solution to this problem using IOT. In this case, the GSM module notifies the collection agent and then plots it on the collection route. This is done since the GPS receiver provides the precise location of that bin when it is ready to be collected. Thus, this project provides an efficient way of garbage collection for the City Council. This research is important as it will help the Council to collect garbage on time and prevent overflow of garbage. Researchers will understand how control systems work and at large it will enhance sanitation in the country as a whole. However, this project covers the aspect of just being able to monitor the level of garbage in the bins and give the exact location of the bins at a particular instant.

In this project we made use of an Arduino Nano, SIM808A GSM/GPS/GPRS module, HC-SR04 Ultrasonic sensor. Some of the elements required for the project to be implemented on a larger scale as well of the roles of these elements are as follows:

Collection team

The collection team that used to work earlier will still work in their usual shifts, the newer team which will use our system will only use their vehicle when a nearby bin is about to overflow. This would allow the newer team to handle only the bins that are about to overflow, after collecting the target bin the system will notify the team if any other bin needs to be regulated if they are nearby

Nodal center

The nodal centers are the points where these vehicles are supposed to dump their garbage's and also the point from where these vehicles begin their shifts. These points are supposed to have garbage vehicles at their disposal if the existing team is far away and nearby bins need to be regulated.

Extra vehicles in nodal center

The nodal center must have some vehicles as their backup option if existing team is far away and will not be able to reach the near nodal center bins

Advantage over current collection system

- This system is providing the stats of all bins so that the garbage teams need not go to regulate an empty or almost empty bin from their nodal centers, this will at least avoid the fuel burnt to reach the empty bin.
- This system is based on IOT so the data from these systems can be used to develop more sophisticated systems
- This system can also help in collecting data about places that provide more waste compared to others so that the government can work with them to reduce wastage
- The data collected from these systems will be useful for generating a new routine for the regular garbage trucks so that the shifts of these workers can be reduced

Logs and GPRS in project:

GPRS: The GPS location of the bins, time and current waste level are all provided using the GPRS module. This allows us to track the bin and check its real time status without going to them.

Logs: Logs in this project are reports about which vehicle regulated which bin. Logs can be stored at node level.

In this way our project provides an efficient system for maintaining wastage from our society.

Improving efficiency for the project:

Our systems can be upgraded in following steps:

1. Getting these bins multiple sensors for accurate and better perspective of data
2. Getting a greater number of vehicles will always allow the centers to handle any unusual situations, also building more nodal centers will also allow the vehicles to change centers and reach further
3. After some months the data from this project can help to build newer cities with well-regulated waste management systems.

CHAPTER ORGANIZATION

This report has been organized into 6 chapters each of which aims to propagate what this project does in a simplistic manner. Chapter 1 shows the general overview of this problem and about our project, this chapter also contains the minor details regarding the merits of this project. Chapter 2 contains the problem background and gives the reader the previous attempts at solving this problem. Continuing to chapter 3 this deals with the software implementation and details about the hardware that was used for this project. Chapter 4 has the design of the project and shows how the program flows. Chapter 5 has the images of the project, this chapter has both the software and hardware images of our prototype bin along with the results obtained during our tests. Chapter 6 concludes the report by giving our view on this project, its scope in future and giving the citations wherever necessary.

CHAPTER 2

LITERATURE SURVEY

- [1] A project “Waste Bin Monitoring System Using Integrated Technologies” proposed earlier in 2014 by Kanchan Mahajan, Prof.J.S.Chitode tackles this project using design of a system based on ARM7 for collecting the garbage. A combination of two trending technologies i.e. Zigbee and Global System for Mobile Applications (GSM) are used in this project. The sensors are placed in the common garbage bins placed at the public places. When the garbage reaches the level of the sensor, then that indication will be given to ARM7 Controller. The controller will give indication to the driver of garbage collection truck as to which garbage bin is completely filled and needs urgent attention. ARM7 will give indication by sending SMS using GSM technology.
- [2] A paper “Smart Dustbin-An Efficient Garbage Monitoring System” proposed by Monika K A, Nikitha Rao, Prapulla S B,Shobha G. in 2016 summarizes that , smart bin built on a microcontroller based platform Arduino Uno board which is interfaced with GSM modem and Ultrasonic sensor. Ultrasonic sensor is placed at the top of the dustbin which will measure the stature of the dustbin.
- [3] Smart Bin Implementation for Smart Cities proposed by Narayan Sharma, Nirman Singha, Tanmoy Dutta This paper describes the application of our model of "Smart Bin" in managing the waste collection system of an entire city. The network of sensors enabled smart bins connected through the cellular network generates a large amount of data, which is further analyzed and visualized at real time to gain insights about the status of waste around the city. This paper also aims at encouraging further research in the topic of waste management.
- [4] Project on “SMART DUSTBIN” proposed by Twinkle Sinha, K.Mugesh Kumar, P.Saisharan in 2017, designed a model for a ‘Smart Dustbin' which indicates directly that the dustbin is filled to a certain level by the garbage and cleaning or emptying them is a matter of immediate concern. This prevents lumping of garbage in the roadside dustbin which ends up giving foul smell and illness to people. The design of the smart dustbin includes a single directional cylinder and an Arduino Uno. The circuit to power up the mechanical devices is also assembled to obtain the desired simulation.

CHAPTER 3

SMART GARBAGE OVERFLOW CONTROL

This project uses Arduino Nano this device can interact with different modules using different pin configurations, the devices that were used for this project are given below:

A. Design Architecture:

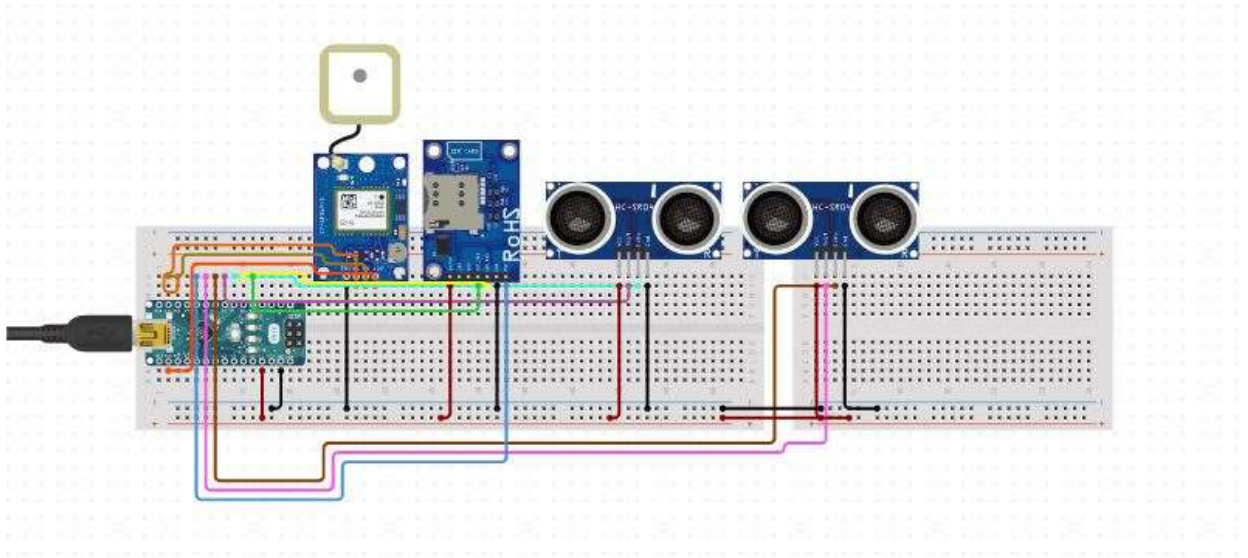


Fig 3.1: Circuit diagram of proposed system

B. Hardware Specification:

1. **Arduino Nano:**

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

2. **SIM 808:**

SIM808 is a quad-band GSM/GPRS module that works on frequencies GSM 850MHz, EGSM 900 MHz, DCS 1800MHz, and PCS 1900MHz. It features GPRS multi-slot class 12/class 10 and supports the GPRS coding schemes CS-1, CS-2, CS-3, and CS-4. The GPS solution offers best-in-class acquisition and tracking sensitivity, time-to-first-fix (TTFF), and accuracy.

3. **Sensors:**

Ultrasonic sensor (UDM):

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It comes complete with ultrasonic transmitter and receiver modules.

These were the hardware components used in our project, the map used for plotting and viewing data for the agent is done using the mapbox api.

MAPBOX:

Mapbox is the creator and a significant contributor to some open source mapping libraries and applications, including the MBTiles specification, the TileMill cartography IDE, the Leaflet JavaScript library, and the CartoCSS map styling language and parser. Using mapbox we're generating the path to a target from a source. Our project however has multiple targets, these bins are then arranged according to their location from the nodes using travelling salesman problem.

Travelling Salesman Problem:

The **travelling salesman problem (TSP)** asks the following question: "Given a list of cities and the distances between each pair of cities, what is the shortest possible route that visits each city and returns to the origin city?"

CHAPTER 4

Design and Methodology

The roles of users and the tasks that are available to them are described using a use case diagram.

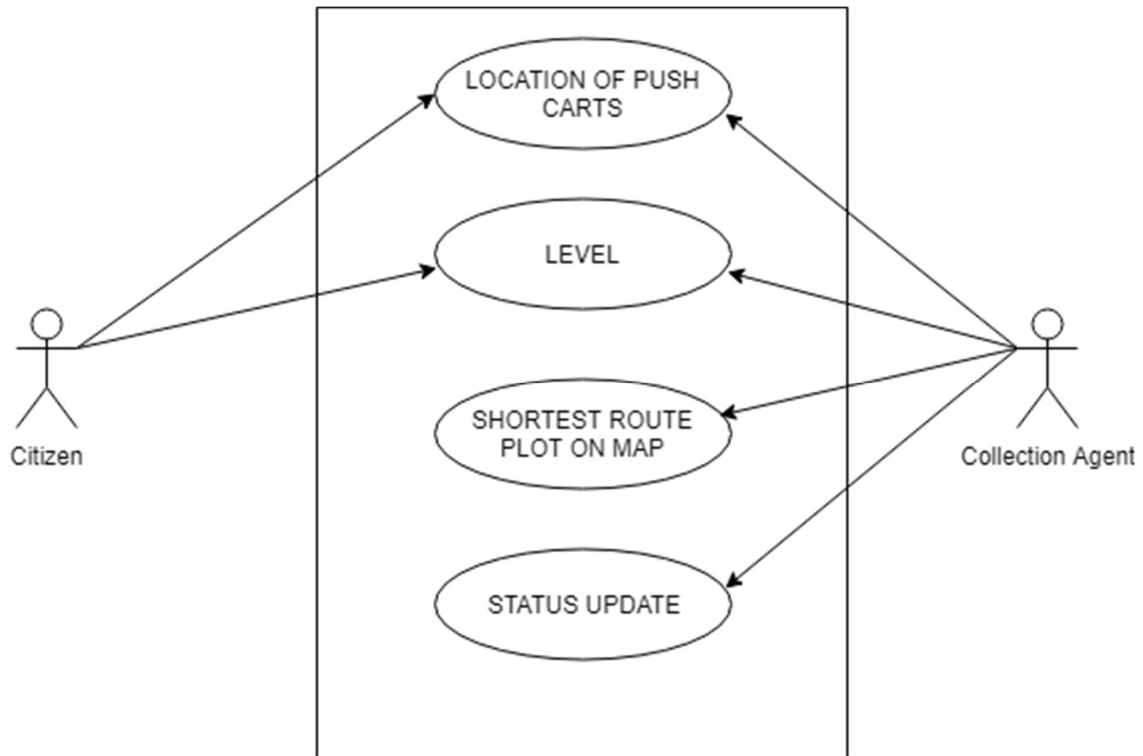


Fig 4.1: Use case diagram of proposed system

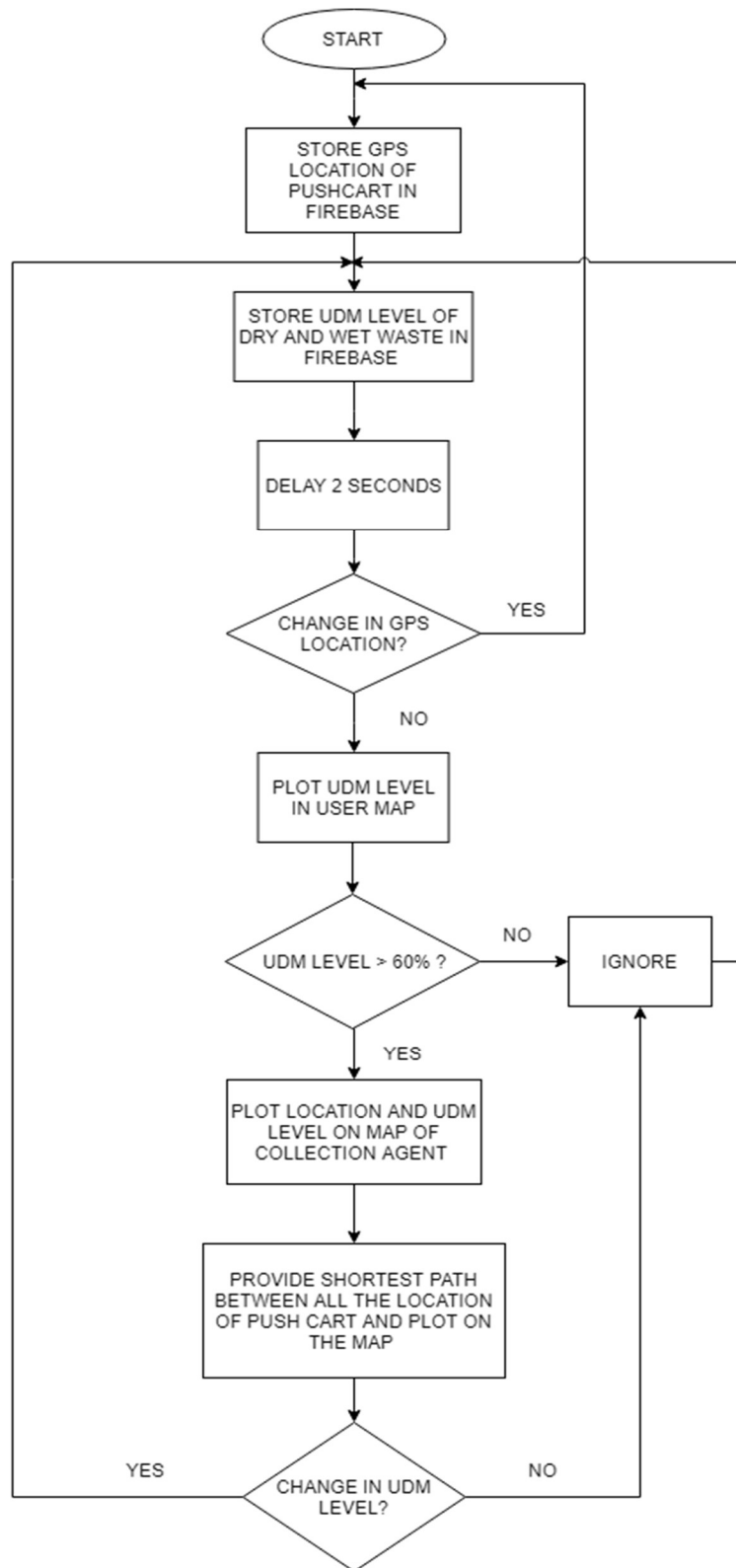


Fig 4.2: Flow chart of proposed system

1. The device will continuously provide the firebase with its location, level of garbage.
2. The garbage level will update the value in firebase and compare it with the threshold hold limits of that area
3. If the garbage level exceeds the threshold limits it will trigger the map at the collection agent's device
4. The collection agent's map will update this bin on the map and will plot it on the existing collection route
5. The agent's route is updated with the shortest path to the bin

CHAPTER 5

SYSTEM SCREENSHOTS

Although most of the system is hardware, the system does have a front end. This front end comprises of a map for showing the live statuses of bins in the area. This map is also able to show the current shortest route between the target bins.

Some of the images from our project are as follows:

1. Image of the prototype device with GSM/GPRS/GSM module

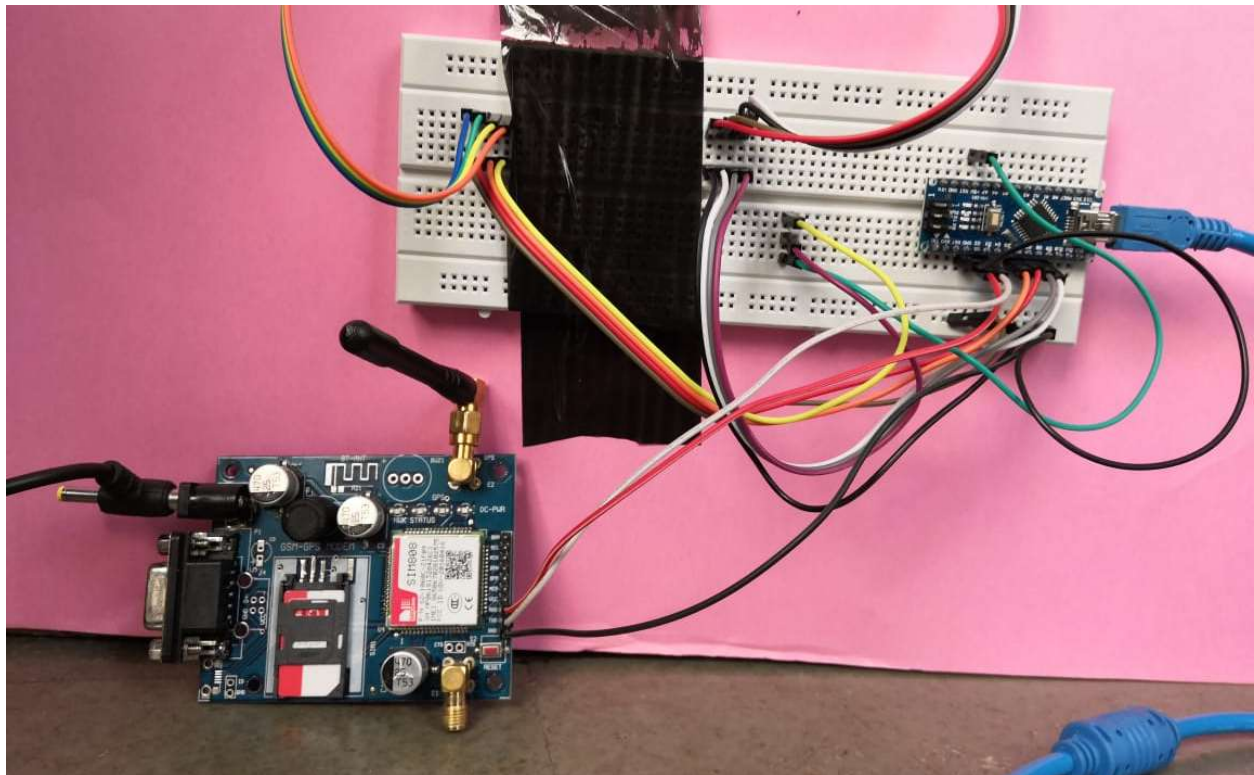


Fig 5.1: Prototype of proposed system

2. Image of the web-app when status of bins needs to be checked

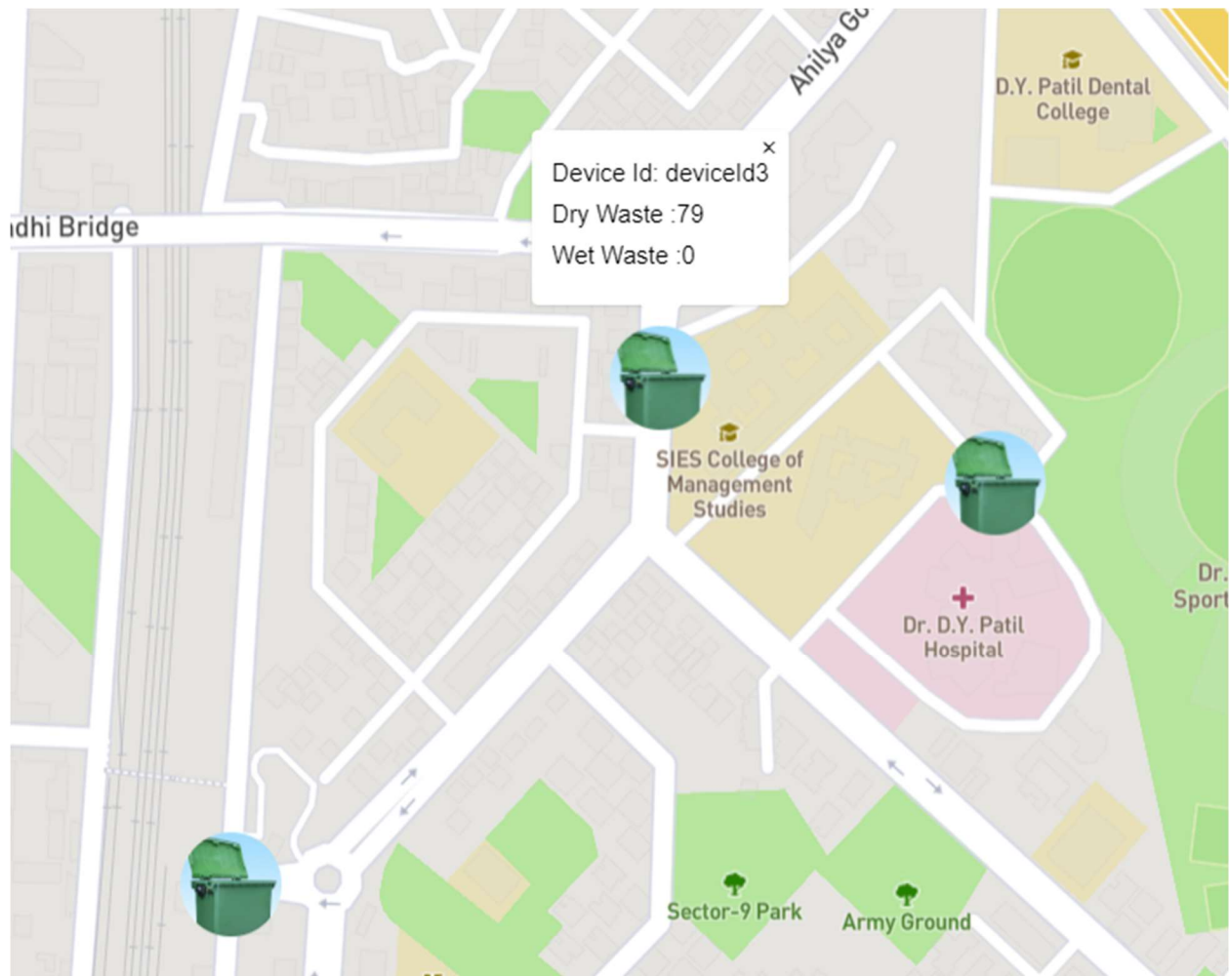


Fig 5.2: Status and Location of push cart in Citizen's UI

3. Image from web-app from collection agent's view

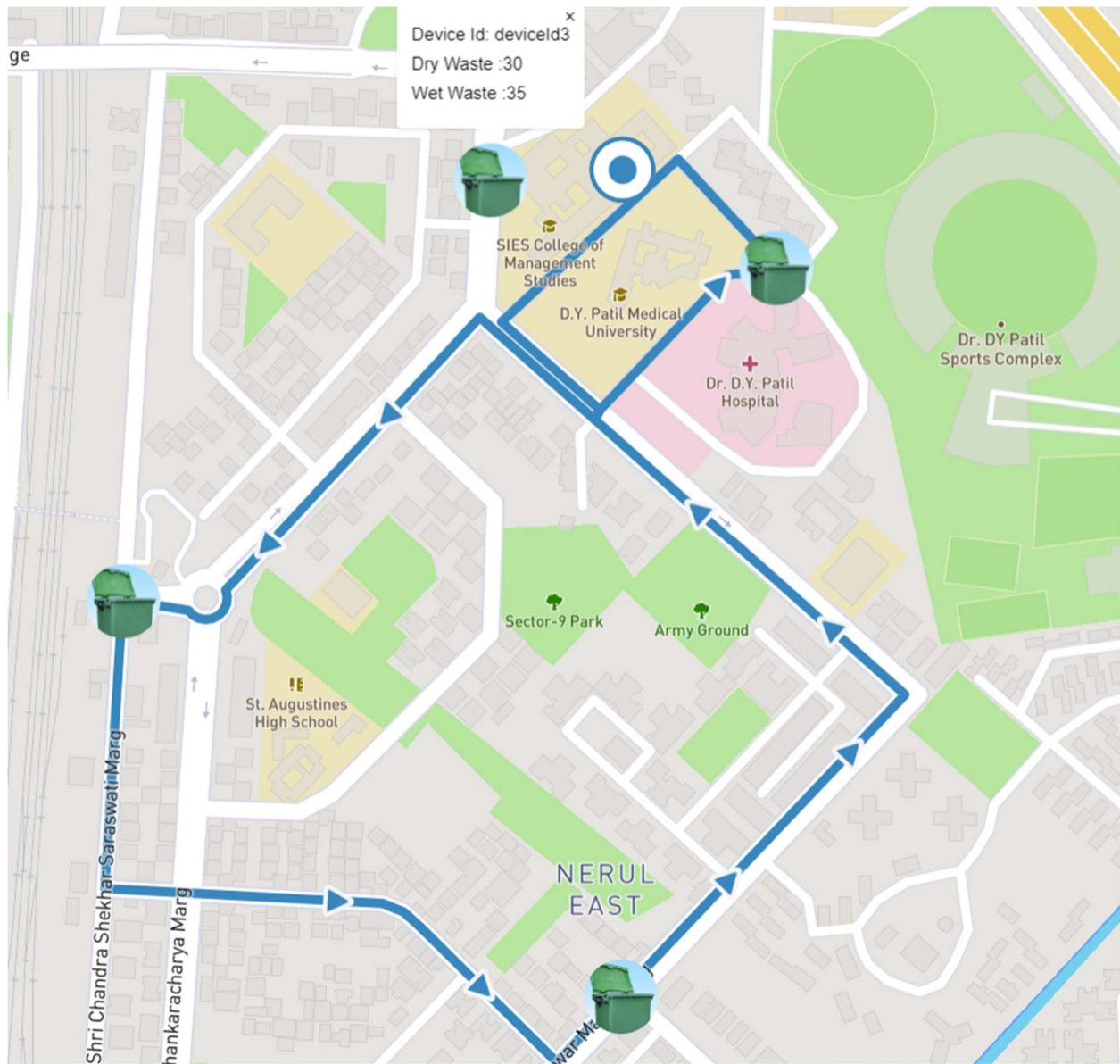


Figure 5.3: Status, Location and Shortest Path Route plotting of push cart in Collection agent's UI

EXPERIMENTAL RESULTS

The results from building this project allows us to phrase that such a project is possible and will contribute to society in a long run, some of the achievements from our project are as follows:

- Linked the device with firebase using device id
- Monitoring and updating the location of device
- Interfacing with ultrasonic sensor and obtaining the height of trash in the dustbin
- Updating the level of trash according to the live data obtained from sensor and updating it on firebase
- Firebase stores and compares it with the threshold data for the bins
- If the threshold limit is breached it will update the map
- When a new trigger is encountered the route to all the target bins is taken into consideration and shortest route between the is calculated
- When the bin is emptied or the location of device changes the device will trigger and send the new data to firebase

CHAPTER 6

CONCLUSION

Through this project we're able to show how IOT can be used to do tasks that will ease people doing jobs for the good of our society. This project although is not able to completely automate the process and will require lot of manual intervention it will still serve as a step towards a society where waste management is not an issue anymore. Our project will gather data that will help in creating a minimal waste city and can help out others that can come up with better solutions for this problem but require real time data for their training dataset.

If the sensors are replaced with camera systems trained to recognize objects then the data gathered from this project will help governments to control the influence of these objects and help out these societies to get better at generating useless waste

FUTURE SCOPE

As mentioned above the project has high potential for growth and some of them are

1. The dynamic routing system will improve dramatically if it is able to take traffic into consideration and generate routes accordingly.
2. The sensors of our project if replaced by camera systems that can recognize objects, brands etc. will help to gather data on the garbage that gets accumulated in the area.
3. The project can be integrated into government projects like **Meri Sadak** under *Pradhanmantri Gram Sadak Yojna* for bringing the attention of common masses
4. This project collects data from these bins and stores them for learning the areas with high waste output and helps to distinguish these areas with priority based collection system.

REFERENCES

- [1] Akshatha.C.S, Apeksha.A.Kotian, Maithri.Rao.K , ShabanaSultana “Garbage Bin Monitoring System for Dry Waste” International Research Journal of Engineering and Technology Volume 4 Issue 4 (Apr 2017)

- [2] Ngosa Willie, Kapata Lucy, Katawa Shadrack, Phiri David Victor, Sinonge John “GSM and GPS Based Garbage and Waste Collection Bin Overflow Management System for Kitwe City Council ” International Research Journal of Engineering and Technology Volume 7 Issue 4 (Apr 2018)

- [3] Nikita Nathrani, Monika Belani, Akansha Agrawal, Shivani Pathak ,Yash Tawarawala, Sanket Kasturiwala “Waste Monitoring System using Internet of Things “ International Research Journal of Engineering and Technology Volume 5 Issue 4 (Apr 2018)

- [4] Monika K A,Nikitha Rao, Prapulla S B, ShobhaG “Smart Dustbin-An Efficient Garbage Monitoring System” International Research Journal of Engineering and Technology Volume 6 Issue 6 (Apr 2016)