IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 11, Issue 6, June 2021, ||Series -II|| PP 23-33

A Structured Process for the Waste Disposal and Maximizing the Recycling of the Waste Using Ml

Bheesetti Ganesh[1], Murali Krishna Vasantha[2]
[1]*M.Tech Scholar (CSE) in Department of Computer Science and Engineering,*
[2]*Assistant Professor, Department of Computer Science and Engineering, Avanthi Institute of Engineering and Technology, Vizianagaram (Dist), Andhra Pradesh, India*
Received 10 June 2021; Accepted 24 June 2021

Abstract:
In Smart Cities generation of waste is increasing due to rapid growth of population, industries in urban areas and the biggest problem to authorities is collection of wastage from different locations. Due to the lack of proper information about 85% of the total municipal solid waste budget is spent on waste collection and transportation. To tackle this problem, we need an intelligent system to monitor waste and to give the complete information to authorities to solve the waste management problem in well-organized manner. Our proposed smart bin uses ultrasonic sensor and machine learning Techniques to identify the status of the bin and update it to the database in a regular interval. This minimize the usage of man power and other resources, moreover the bin uses image processing technique to identify the plastic bottles in the waste. This helps to segregate the biodegradable from non-biodegradable waste. It also helps to identify any suspicious material being placed in the bin. The best performing solution also improved the quality of forecasts for emptying time of recycling containers.
Keywords: Smart Waste Management, Sensors, Machine Learning Techniques, etc.

I. INTRODUCTION

RECENT advancements in communication technology using wireless sensor devices opened vast opportunities for developers and researchers of many intelligent smart systems developed for social relevant applications. Using this everyone is migrating to select only smart mobile phones, smart sensors, smart home automation, smart irrigation system etc. It permits all individuals and things to be more smart and connected to the Internet world. Hence, we can call it as Internet of Everything. To facilitate new smart services and redesign the active devices in smart cities are very effective,. In this case garbage collection is reshaped to Waste Collection as a Service. Dynamic scheduling and collecting waste are the manual process, but done efficiently through online. There are two Issues connected to smart waste collection. First how frequently collect waste from bins and secondly how to inform this to the municipal authorities. Smart Bin, is a garbage collecting dust bin, which is self-aware and detects the level of the waste in the dustbin, based on that it can send alert messages to the municipal authorities, so the authorities make the arrangements to replace the dustbin. This type of Worldwide interest in Smart Cities has aggrandized, fostered by the need to find effective remedies to the major challenges foreseen for the next years. As one of the application of Smart City, Waste Management in a city is a formidable challenge faced by the public administrations. Waste is defined as any material in which something valuable is not being used or is not usable and represents no economic value to its owner, the waste generator. Depending on the physical state of the waste, they are categorized as solid waste and wet waste. With the proliferation of population, the scenario of cleanliness with respect to waste management has become crucial. Waste management includes planning, collection, transport, treatment, recycle and disposal of waste together with monitoring and regulation. The existing waste management system, where the garbage is collected from the streets, houses and other establishments on quotidian basis, is not able to effectively manage the waste generated. Giraud village in Raipur district, the capital of Chhattisgarh have deployed garbage bins at every street to collect the garbage, engaged its laborers and vehicles to clear the trash. The amount of total solid waste generated by the village is 558 kg/day and liquid waste is 108040 lit./day, the garbage is collected daily and dumped into landfills. In case a villager observes illegal dumping of any kind of waste, he/she can complain regarding this to the concerned department. As improper disposal of waste causes serious impact on health, causing the spread of diseases and problems to the surrounding environment, the complete care is taken by the government for collecting and disposal of waste. In this paper, a model has been proposed for real-time monitoring the garbage level of respective garbage bins and to detect the level when threshold value is reached using combination of Sensors and Raspberry pi. This data will be sent to the control unit and updated timely with the help of WiFi- module, depending on which optimized route have to be found for Garbage Collecting Van (GCV), depriving the fuel consumption, cost, time and labor. The data will be provided whether the waste is segregated completely or not by wet sensor and humidity sensor which will help for recycling, disposal and

reuse of waste. Using data mining, qualitative analysis will be carried out to generate reports. The main objective of this system to be implemented is to supersede the tedious existing system which will aid city to become a Smart City.

II. RELATED WORK

P. Reis et al. developed the iEcoSys system (Intelligent Ecologic System). It is a technical tool that identifies the waste produced individually, using RFID tags embedded in garbage bags – the iBags. When put down waste, the recycling center identifies and weighs every bag and the composed data is sent to a server system using ZigBee communication standard [4]. V. Wilson et al. announces an automatic system called SWACH (Smart Waste Collecting Hopper) that helps to collect garbage without human interference. SWACH has a web portal introduced on a server using which the user can identify the time of garbage collection. The system peripherals are executed using Arduino that senses the environment and provides essential actuation. SWACH wirelessly communicates to the server to obtain the directionfinding information, using Raspberry Pi, thus porting the complete application on IOT. It is also equipped with the proficiency of detecting and avoiding obstacles that barrier its path [5]. A. Bharadwaj et al. providing a complete IOT enabled system, the process of tracing, gathering, and managing the solid waste can be simply automated and monitored efficiently. By the use of sensors, we collect data from the rubbish bins and send them to a gateway using LORA technology. The information from many garbage bins are collected by the gateway and sent to the cloud over the Internet via the MQTT (Message Queue Telemetry Transport) protocol. The main advantage of the planned system is the usage of LORA technology for data communication that facilitates long distance data transmission using low power consumption as compared to Wi-Fi, Bluetooth or Zigbee [6]. E. Ramya et al. proposed a smart trash bin, if it fills the trash bin it will send the notification to authorized person by GSM then the garbage is dumped into waste land. In this GSM will do the vital role to send an SMS to authorized persons [7].Dr. N Satish Kumar et al. designed a system that it avoids the overspill of the garbage bin by sending alerts using a microcontroller linked to a web server using IOT. It also offers the verification process after cleaning the dustbin. The status of the garbage bins is calculated by evaluating the distance of the nearby obstacle using an ultrasonic sensor. Arduino UNO R3 is being used as the microcontroller to read the data from the ultrasonic sensor. It is programmed to send a notification to the Thing Speak web server if the garbage reaches a certain distance. An RFID reader is interfaced with the Arduino for the verification process. When an RFID tag (ID card of the cleaner) interrupts the RFID reader, the ultrasonic sensor checks the status of the trash bin and leads it to the web server. By using An Android app to view the alerts and status of garbage bin at the server end [8]. A. Mohan et al. offers a waste collection mechanism using an IOT use ultrasonic sensor to find the level of the garbage in the bin Weight sensor supports to differentiate light waste like paper and heavy wastes. Some garbage produces an insufferable smell, hence MQ Gas sensor is used to find the smell. These sensors are devoted to the Arduino UNO microcontroller which sends the information to a Raspberry Pi. The sensor values are constantly observed, when it touches the threshold value(s), Raspberry Pi sends the data to the Thing Speak IOT cloud boards. A message is sent to the municipality server and then a garbage clean-up is authorized for the corresponding garbage can [9].

III. SOLID WASTE MANAGEMENT

Solid Waste Management in Asia

As urbanization and economic development increases in Asia, nowhere is the impact more obvious than in society solid waste. Today, the urban areas of Asia produce about 760,000 tones of solid waste (SW) per day, or approximately 2.7 million m3 per day. In 2025, this figure will increase to 1.8 million tons of waste per day, or 5.2 million m3 per day. These estimates are conservative; the real values are probably more than double this amount. Local governments in Asia currently spend about US $25 billion per year on urban solid waste management. To carry out integrated solid waste management, local governments need partners. The general community, which is probably the most important stakeholder in waste management activities, must also actively, participates in the solutions by modifying their behavior patterns. in 2025 about 52 percent of Asia ‘s population will reside in urban areas, and evidence that urban residents generate at least two times more waste per capita than their rural counterparts. Given these factors, it is clear that solid waste management efforts must target priority urban areas.

Solid Waste Management in Us

As a nation, Americans generate more waste than any other nation in the world, officially with 4.4 pounds (2.0 kg) of Municipal Solid Waste (MSW) per person per day, with another study estimating 7.1 pounds per capita per day. Fifty five percent of this waste is contributed as residential garbage, while the remaining forty five percent of waste in the U.S.'s ‘waste stream' comes from manufacturing, retailing, and commercial trade in the U.S. economy. over 14 pounds of non-recycled, un reused items, often ending up into landfills and

incinerators per day, eight pounds over the national state daily throwaway average. "Wasteful" states Michigan, Mexico, Wisconsin and Oregon as well as Washington also dominated the list's 5-year period. The generation of SW has grown steadily over the past thirty years, from 88 million tons per year, or 2.7 pounds per person per day in 1960, to 229.9 million tons, or 4.62 pounds per person per day in 1999. The largest component of the SW stream is paper and paperboard products (38.1%), with yard trimmings the second most predominant component (12.1In 1960 about 7 percent of MSW was recycled, and in 1999 this figure had increased to 27.8 percent. How MSW is managed is shown in the bottom of two pie charts on the next page. Although the majority of solid waste is still sent to landfills, statistics indicate that there is a clear trend away from reliance on this method. Combustion of MSW and recovery through recycling are now a common practice in the United States.

Solid Waste Management in Malaysia

National Space Agency Malaysia (ANGKASA) under Ministry Of Science Technology, Innovation Malaysia (MOSTI) taking an initiative to developed Smart Waste Management System (SWMS)**.** SWMS is one of the modules developed in Spatial Smart City Service Delivery Engine (SSCSDE) Project funded by Most under Techno fund grant. The Objective of the project is to develop a spatial service delivery engine that are capable of exploiting the smart (geospatial) technologies to support city operations which includes managing, using, and exploring spatial data with scientific analysis in all possible phases of the decision making process in the organization. The reason and idea for choosing SWMS as one of the development module is to monitor the environment by enforcement. Local authority always have difficulty to monitor the job done by waste collection services provider. Contractor doing waste collection services seems doing collection not follow the schedule as per agreed in contract. Hence SWMS will act as automatic enforcement system to penalize the contractor who break the contract. This solution not only help local authority to monitor the contractor, it's also brings information of garbage container status and report automatically when it's full. This valuable information can be used by local authority for monitoring purpose and enforcement. For waste collection contractor this information provide alerts on the status of containers in terms of fill levels in order to optimize collection routes based on historical and real time information hence save operation cost.

IV. SMART WEASTE MANAGEMENT SYSTEM IMPLEMENTATION

ENEVO

Enevo one is a comprehensive logistics solution that saves time, money and the environment. It uses wireless sensors to measure and forecast the fill-level of waste containers and generates smart collection plans using the most efficient schedules and routes. The solution provides up to 50% in direct cost savings. Receive automatically generated schedules and optimised routes which take into account an extensive set of parameters future fill level projections, truck availability, traffic information, road restrictions, container and content types the vehicle can collect etc. New schedules and routes are planned not only looking at the current situation, but considering the future outlook as well. Enevo using WSN and Ultrasound sensor for measuring the fill level of waste container [3].

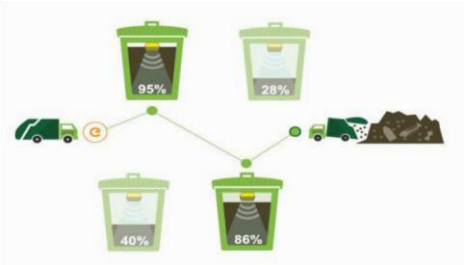


Fig 1 Enevo system Architecture

IR Sensor

Dustbins are the primary infrastructure required. Separate dustbins are allocated for dry and wet waste respectively, each of which is equipped with suitable low power sensor circuitry to detect the fullness and heaviness, and transmitters to send a message to the nearest GCV when it is full. Sensor circuitry Infrared (IR) light is electromagnetic radiation with a wavelength longer than that of visible light, measured from the nominal edge of visible red light at 0.74 micrometers (μ m), and extending conventionally to 300 μ

m. These wavelengths correspond to a frequency range of approximately 1 to 400 THz, and include most of the thermal radiation emitted by objects near room temperature. Microscopically, IR light is typically emitted or absorbed by molecules when they change their rotational-vibration movements. Infrared light is used in industrial, scientific, and medical applications.

BIO Sensor (load sensor)

It comprises the use of biosensor sensor and weight sensor along with height sensor to sense the run over of the waste in the waste bin and the intensity of pollution caused by undesired poisonous gases from the waste bins. Afterwards, these sensors are fed to the controller to help the GSM module to send the notification to the respective authority about the status of waste bin.

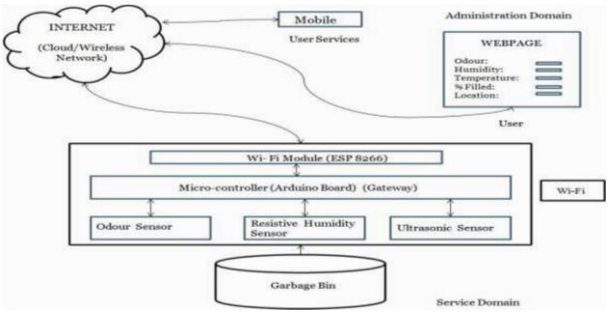


Fig 2 Block Diagram of Bio sensor

SENS Dumper

SENS dumpster filling level monitoring SENS dumpster is an innovative device that monitors the filling level of a dumpster. SENS dumpster works with any kind of waste and fits to any type of dumpster. It makes use of a volumetric sensor that provides information of the level of filing of a dumpsters. SENS dumpster can be applied to any kind of waste, and a temperature sensor is able to detect significant temperature increases that may result in fire. SENS dumpster is a fully ZigBee wireless device that can be integrated to any ZigBee network deployment within the smart-city.

Fig 3 SENS dumpster wireless device to monitor filling level of dumpster.

V. PROPOSED SYSTEM:

However, the quality of filling level predictions will determine the efficiency of a Smart Waste Management system. There are several technical challenges for achieving a high quality predictions. Our analysis of an operating Smart Waste Management system revealed that one of these challenges is a problem of an accurate detection of a container being emptied using the measurements from a sensor mounted on top of a container. As it is demonstrated in, the quality of filling level predictions depends on the correct detection of emptying. Inaccurate detections devalue filling level predictions; therefore, detection of container emptying is an integral step in obtaining qualitative predictions. Therefore, this article applies the proposed methodology to the problem of the emptying detection. Moreover, this study for the first time draws attention to the challenges and importance of the emptying detection for the functioning of Smart Waste Management systems.

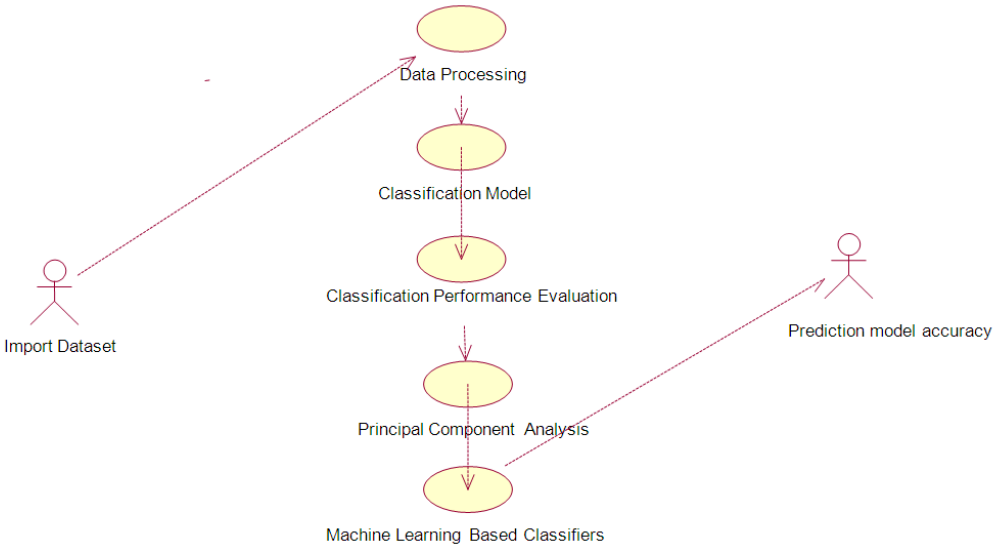
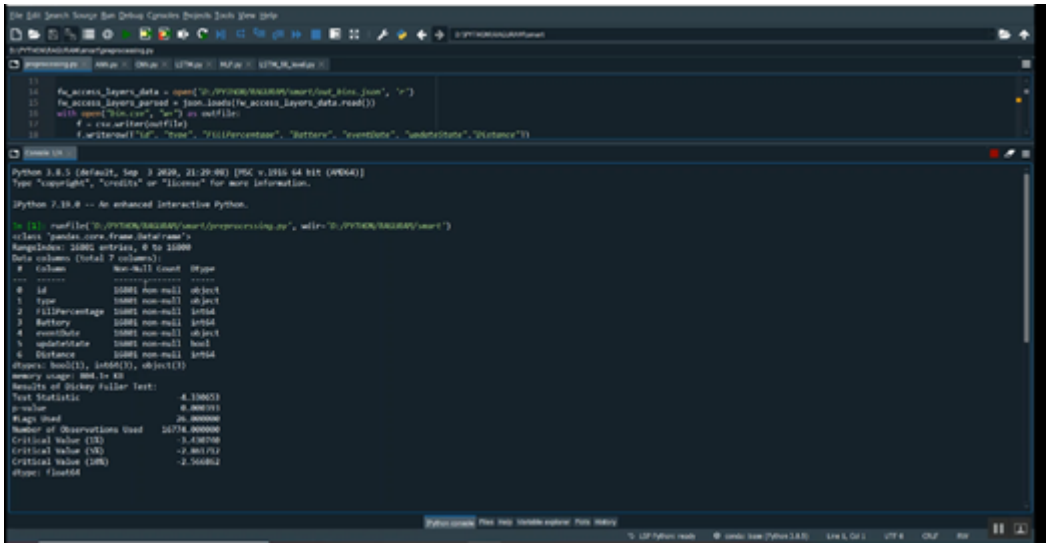
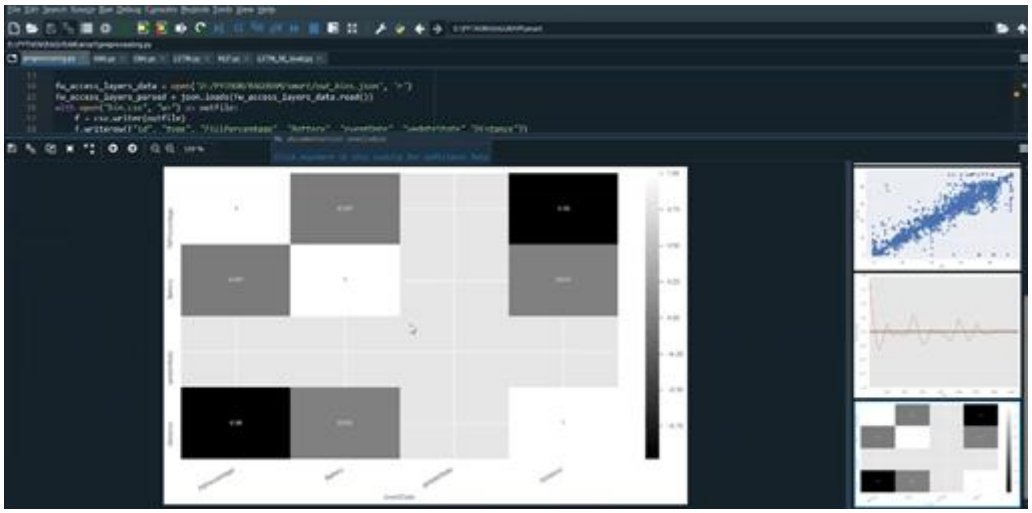
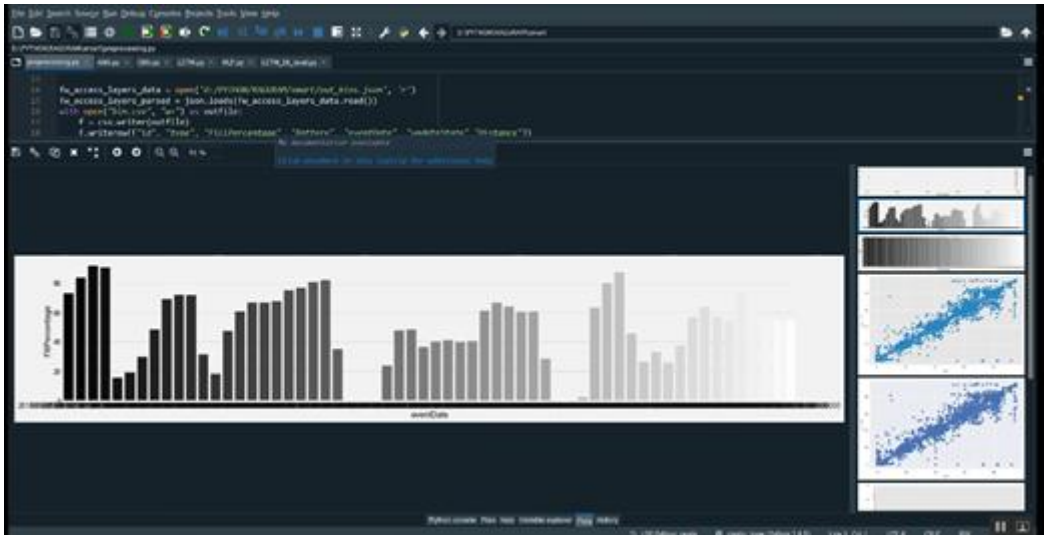


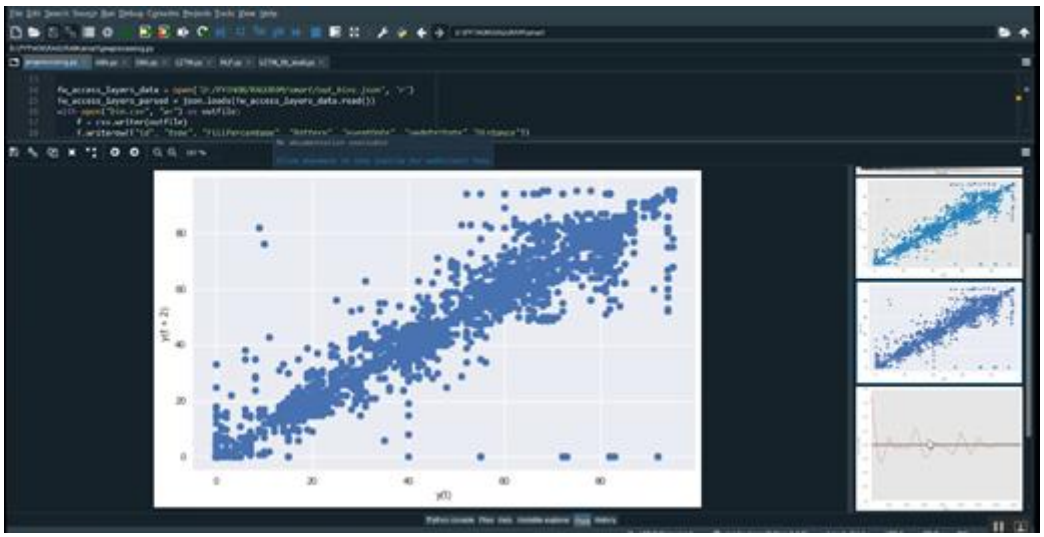
Fig 4. Proposed System Architecture diagram

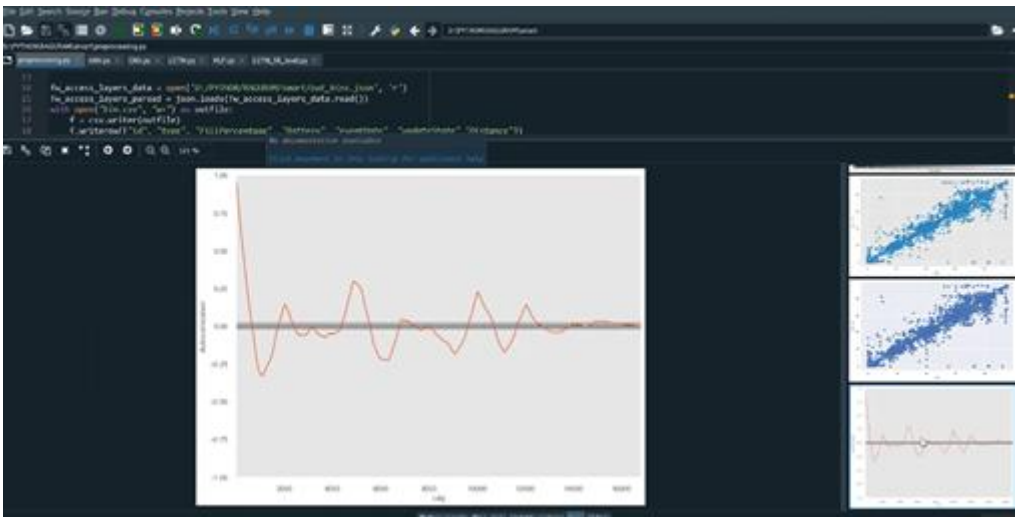
VI. RESULTS

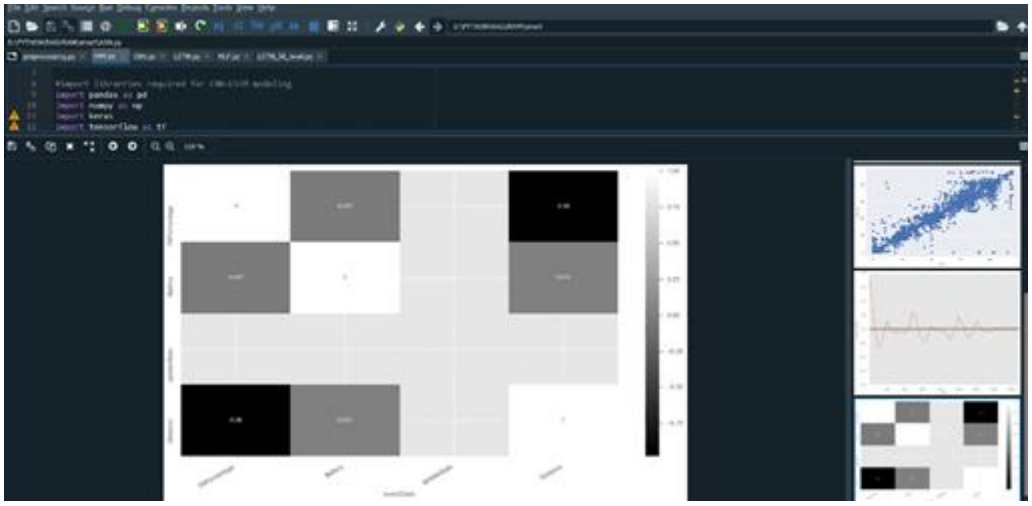


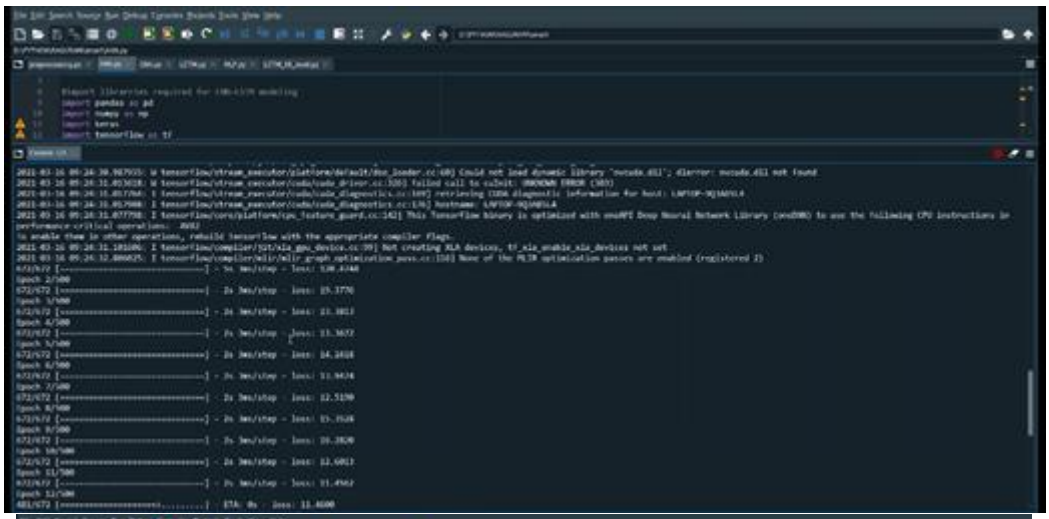


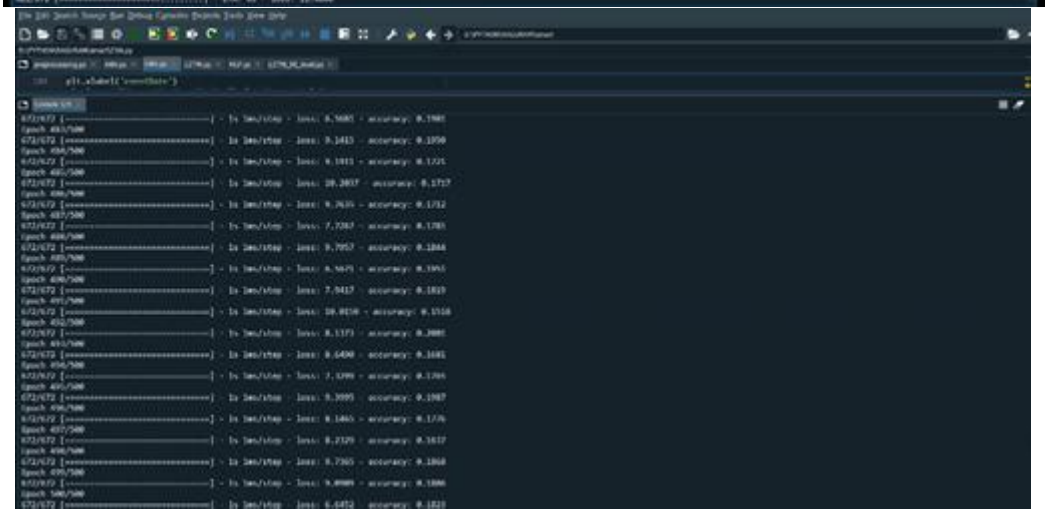


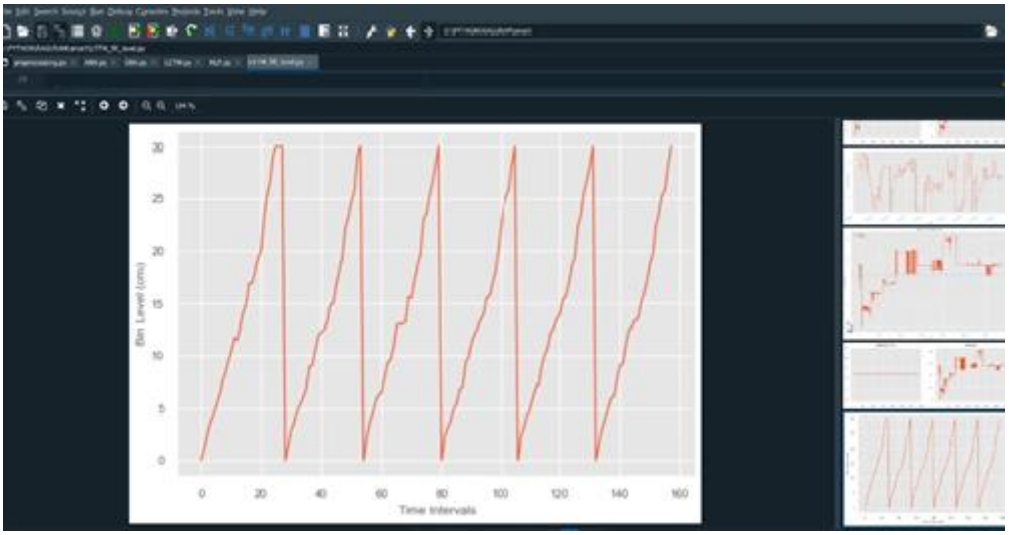


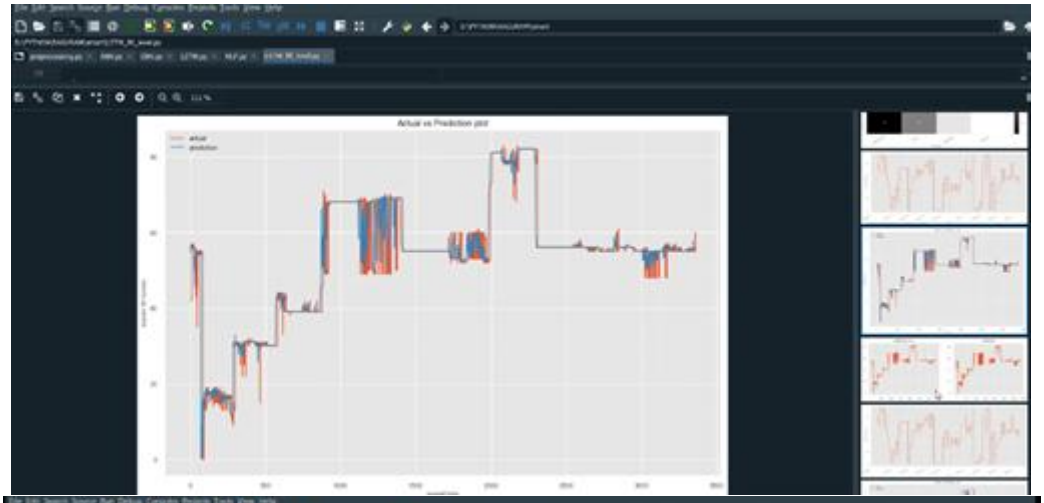


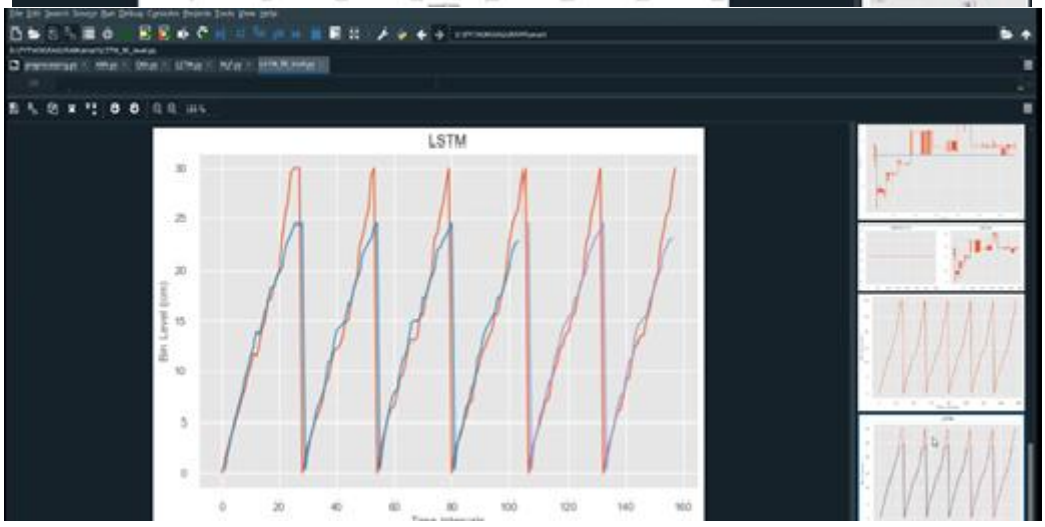


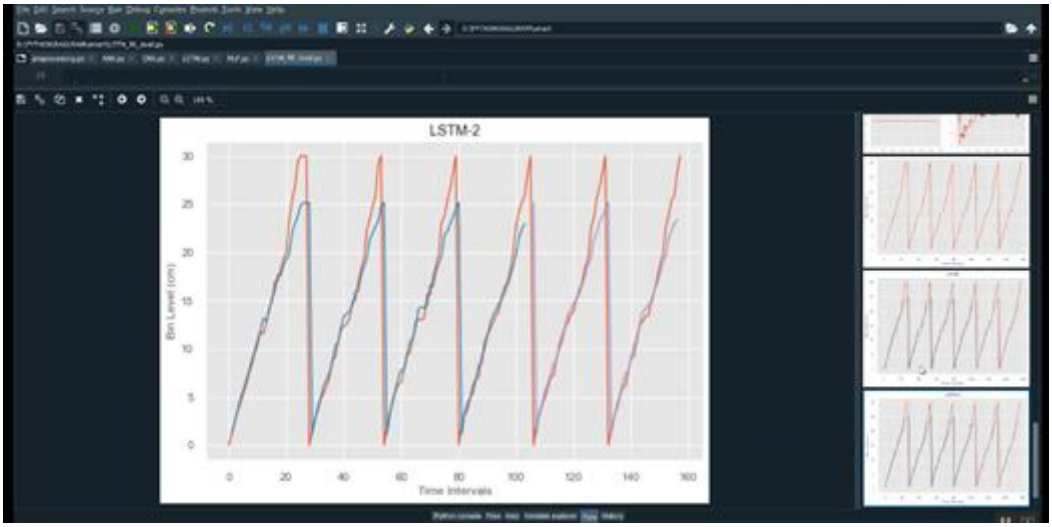


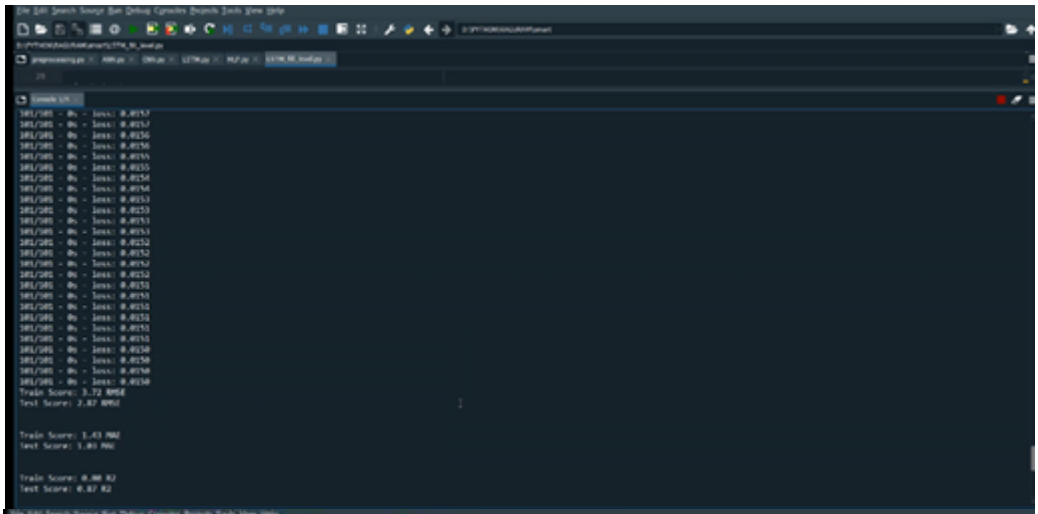


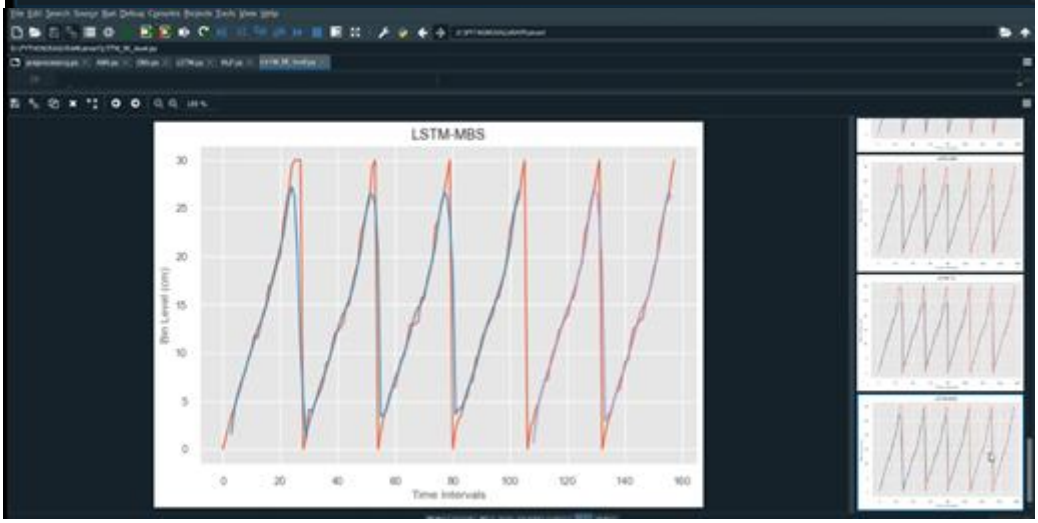

Bin Level (cm)
Time Intervals

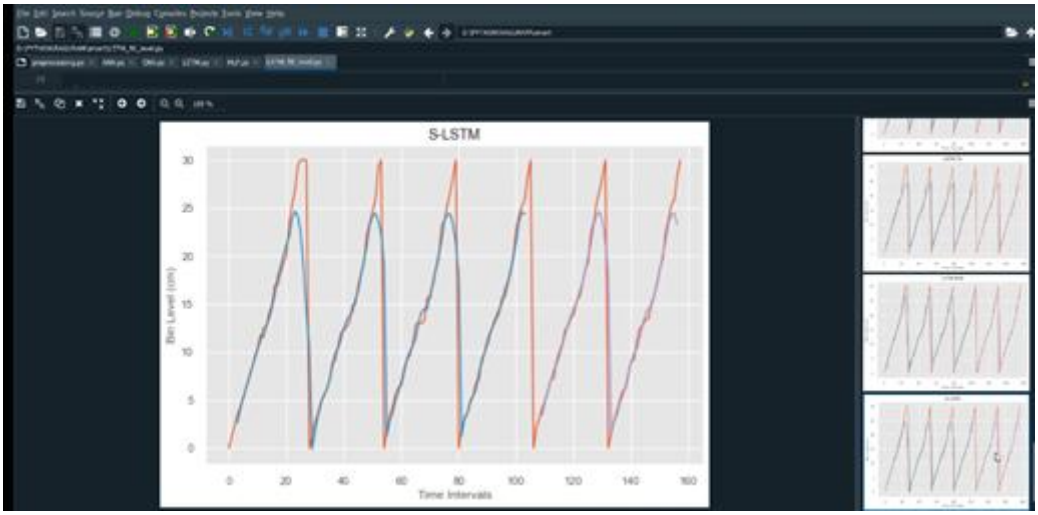


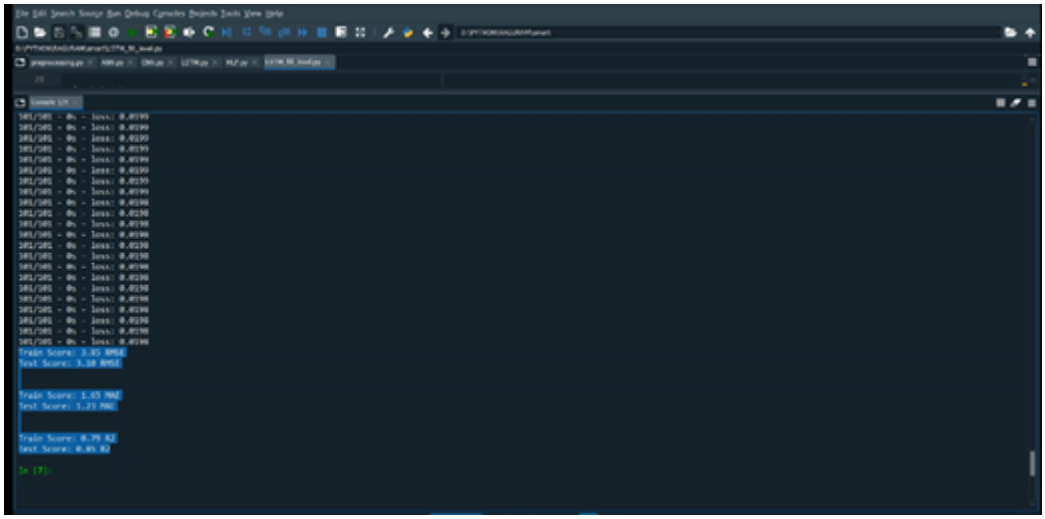

LSTM
Bin Level (cm)


LSTM-2
Bin Level (cm)
Time Intervals




LSTM-MBS
Bin Level (cm)
Time Intervals





VII. CONCLUSION:

The waste segregator has been successfully implemented for segregation of waste into biodegradable and non- biodegradable waste at a domestic level. However, the noise can be eliminated from the sensor modules to increase the accuracy and efficiency of the system. This system has its own limitations. It can segregate only one type of waste at a time since having different types of wastes at once can create problems in effectively segregating. Thus, improvements can be made to segregate mixed type of waste by the use of buffer spaces. the iterative data-driven methodology for achieving the highest performance where first the existing solution to the problem was assessed, second this solution was optimised using the collected dataset, next, machine learning algorithms were applied to the problem, and finally, the feature engineering was used to find if additional features would improve the results. (Random Forest) allowed significantly improving the performance reaching the accuracy of 99:1 % and the recall of 98:2 %.

Future Work:

Our future aspiration is to improve the segregation process to support more waste to added to it. This would make the smart bin more usable for household by dumping all wastes rather than adding the waste one by one. We would also like to reduce the cost of the sensors which would effectively reduce the cost of the smart bin, making it more affordable for the people

The set of extended features was formed using Recursive Feature Elimination algorithm and included the filling level before a potential emptying as well as three different filling level changes: the immediate change, the change in three hours, and the change in twelve hours. Moreover, we performed the experiment assessing the effect of improved emptying detection on the emptying time prediction.

REFERENCES

[1]. M F Omar, A A A Termizi, D Zainal, N A Wahap, N M Ismail, N Ahmad. "Implementation of spatial smart waste management system in Malaysia". 8th IGRSM International Conference and Exhibition on Remote Sensing & GIS, IOP Publishing. doi:10.1088/1755-1315/37/1/012059.

[2]. Adil Bashir, Shoaib Amin Banday Ab. Rouf Khan, Mohammad Shafi. "Concept, Design and Implementation of Automatic Waste Management System". International Journal on Recent and Innovation Trends in Computing and Communication (ISSN 2321 – 8169) Volume: 1 Issue: 7 Page: 604 – 609.

[3]. Jose M. Gutierreza, Michael Jensenb, Morten Heniusa and Tahir Riazc. "Smart Waste Collection System Based on Location Intelligence". Procedia Computer Science 61 (2015) Page: 120 – 127

[4]. Parkash, Prabu V. "IoT Based Waste Management for Smart City". International Journal of Innovative Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organization) Vol. 4, Issue 2, February 2016.

[5]. Vikrant Bhor, PankajMorajkar, Maheshwar Gurav and Dishant Pandya. "Smart Garbage Management System". International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 IJERTV4IS031175 Vol. 4 Issue 03, March-2015.

[6]. Insung Hong, Sunghoi Park, Beomseok Lee, Jaekeun Lee, DaebeomJeong, and Sehyun Park. "IoT-Based Smart Garbage System for Efficient Food Waste Management". The Scientific World Journal Volume 2014 (2014), Article ID 646953.

[7]. Chaitanya More1, Darshan Mestry2, ParagKedia3, Reshma4-"Efficient Garbage Collection Using Wsn" International Journal of Research in Engineering and Technology eISSN: 2319 -1163 - pISSN: 2321-7308., Volume: 05 Issue: 01- Jan-2016.

[8]. Akshay Bandal, Pranay Nate,Rohan Manakar,Rahul Powar. "Smart Wi-Fi Dustbin System". International Journal of Advance Research, Ideas and Innovations in Technology. 2016.

[9]. Michael Batty, Kay Axhausen, et al., "Smart Cities of the Future,"ISSN 1467-1298, Paper 188 - Oct 12.

[10]. Narayan Sharma,, "Smart Bin Implemented for Smart City", International Journal of Scientific & Engineering Research,sep-2015.

Authors

Bheesetti Ganesh Holds a B.Tech Degree in Computer Science & Engineering from Welfare Institute of Science Technology And Management, PINAGADI , PENDURTHY, Vishakapatnam -531 173, Andhra Pradesh. He is presently Pursuing M.Tech (CSE) in Department of Computer Science and Engineering from Avanthi Institute of Engineering and Technology Cherukupalli(V), Near TagarapuvalsaBridge,Vizianagaram (Dist) - 531162,Andhra Pradesh. Area of interest include Full Stack Web application Development, Python Programming, Machine learning and Data science.

Mr.Murali Krishna Vasantha Working as Asst.Professor, Department Of Computer Science and Engineering in Avanthi Institute of Engineering and Technology Cherukupalli(V), Near TagarapuvalsaBridge,Vizianagaram (Dist) - 531162,Andhra Pradesh. He has More than 11 Years of Teaching Experience in Various Colleges in Andhra Pradesh. His Area of interests include Machine Learning, Artificial intelligence,BlockchainTechnology,MEAN Stack,Data mining with Outlier Detection and Microsoft POWER BI Consulting Service .