भारतीय अंतरिक्ष विज्ञान एवं प्रौद्योगिकी संस्थान
Indian Institute of Space Science and Technology
तिरुवनंतपुरम / Thiruvananthapuram - 695 547

सं./ No. आईआईएसटी / IIST प्रशा./Admn/222/20 प्रशासन / Administration

3rd March 2020

Sub: Report of the Swachh Bharat Pakhwada Campaign held from 1st to 18th of February .2020

Vide letter no: CEPO/CPG/Gen-85/SAP dated 18.12.2019, Director, CEPO had communicated an action plan for observing Swachata Pakhwda Campaign from 1st February 2020 to 15th February 2020 based on the guidelines issued by Cabinet Secretary, GOI. It had been strictly advised to observe the action plan and furnish day wise report along with photographs / videos by email so as to enable CEPO to upload the same in the Swachhata Samiksha portal of MDSW.

The Swachhta Pakwada campaign from 01.02.2020 – 18.02.2020 was planned and executed well in IIST as advised.

The letter referred above had also advised that the expenditure towards Swachhta Pakhwada activities are to be booked under separate budget head created for Swachhta Action Plan (SAP) – Object Head '96' debitable to the Demand no: 93, Department of Space. Since IIST is a autonomous body, the budget provision has to be made from the grant in aid itself. So Director has approved for a suitable budget head to be created and budget allocation be made every year for SAP.

The activity proposed in the communication received from Director, CEPO was as below

Sl. No	Day	Category	Activity proposed by DOS
1	Day 1 (01.02.2020)	Mass Pledge	Mass pledge by officers and staff with resolution to eradicate use of plastic in offices and make DOS / ISRO campuses a 'Plastic Free Campus.
2	Day 2 (02.02.2020)	Plogging	Plogging run by officers and staff lead by senior officials of DOS/ISRO to pick up plastic litter in and around the campus
3.	Day 3 to 8 (03.02.2020 to 08.02.2020)	Plastic waste management	• Collection of plastic waste at DOS/ISRO campuses and housing colonies • Disposing off the collected plastic waste through authorized / registered recyclers • Installation of plastic shredding machines at DOS / ISRO campus • Use of non-recyclable plastic in minor construction works • Distribution of Steel /copper water bottles to all DOS/ISRO offices (so as to curb the use of SUPs) • Promoting alternate choices for plastic products • Cleaning drives at office premises, housing colonies and nearby villages on campaign mode with mass participation of employees / family members to achieve plastic free campus
4	Day 9 to 11 (09.02.2020 – 11.02.2020)	Outreach and Awareness	• Awareness talks at DOS/ISRO campus and housing colonies on segregation of waste at source with a focus on eradicating plastic items • Conducting competitions – essay, debate, painting etc at nearby school • Organising street plays on plastic waste

			management at ISRO premises • Swachhata procession at nearby villages to spread awareness on plastic harmfulness and necessity to avoid / reuse the same.
5.	Day 12-14 (12.02.2020 – 14.02.2020	Advertisement	• Press conference by senior officials on Swachhata Pakhwada activities at DOS/ISRO • Advertisement in social media platforms • Update alerts on ISRO internet and intranet portal • Display of posters/flyers in notice boards /digital displays at ISRO campuses • Distribution of pamphlets, stickers, flyers (made in local languages) at villages and public area, promoting awareness on waste management, hygiene, cleanliness etc. • Distribution of jute shopping bags to nearby villages
6.	Day 15 (15.02.2020)	Awards	• Initiate action to award best ISRO centre who actively participated in Swachhata Pakhwada with key focus on innovative contributions

Based on the above guidelines issued by Cabinet Secretary, GOI, the following activities were organised in IIST

Sl. No	Category	IIST Action plan
1.	Plastic waste management	1. Plogging was conducted on 05.02.2020 (Wednesday) afternoon in IIST campus with utmost vigour and enthusiasm. Registrar, IIST lead the institute in this enjoyable but most useful activity. He was accompanied by students and staff all through the campus. This provided a complete exercise apart from the mental satisfaction of keeping the our campus clean. While traditionally, cleanliness leads to a healthy lifestyle, the reverse is true with plogging run. Truck loads of waste was collected and suitably disposed. 2. Haritha Karma Sena, an initiative of Nedumangad Municipal Corporation collected cleaned plastic waste from the campus. A cleaning facility had been arranged. So the party is entrusted the task of removing collected and cleaned plastic waste from the campus. Specific areas are earmarked to collect the complete plastic waste generated in the campus. Suitable penalty will be imposed on those not adhering to the instructions given on the subject. 3. All major offices in the institute are now utilizing glass bottles for water storage and consumption. Use of Single use plastics have already been stopped. 4. It has been approved to provide steel coated copper water bottles for faculty and staff. Indent for the same is already initiated. The same is being arranged for sale in the campus during festivals like Conscentia and Dhanak at subsidized prices. 5. Cloth bags with IIST logo and Swachh Bharat message as per the action proposed by DOS in SL 5 is also under process . This will be supplied to all students and staff of IIST as well as to people in nearby areas. 6. Institute has stopped the use of flex boards for functions. The lamination of files and use of plastic folders in future is also be stopped. 7. The use of SUPs is completely avoided in all major functions such

		as Dhanak, Conscentia, Onam, Diwali, Holi etc. 8. Since construction works are ongoing in the campus, Head CMD is reviewing the feasibility of using non-recyclable plastic in the same.
2.	Outreach and Awareness	1. Since 01.02.2020 was a Saturday and IIST was conducting its Annual Sports Meet on that day, the mass pledge administered as part of the inaugural programme as students, faculty members and staff had assembled for the event. 2. Students under the guidance of Dr. Lekshmi V Nair attended meeting of 'Ayalkoottam' (Neighborhood Groups of women) on 18.02.2020 to spread awareness on plastic harmfulness and necessity to avoid / reuse the same. The report of the same is attached separately along with photographs. 3. Quiz Programme was coordinated by Dr. C.S. Shaijumon along with IIST students in V.K.Kani HS, Panakode, Nedumangad on 11.02.2020. 4. Students under the leadership of faculty members Dr. Rajesh V.J and Dr. Mahesh S visited two colonies near the campus and made a comprehensive study on 18.02.2020. The report along with photographs are attached separately. 5. The Nirmaan group of the institute who are actively participating in the Sarva Shiksha Abhiyaan program in nearby schools are now linking the Swachhata Abhiyaan program and educating the students on Swachh Bharat Abhiyaan also. 6. IIST website and social media pages is updated on the Swachh Bharat Abhiyaan activities in the Institute. It is also planned to showcase various methods of maintaining cleanliness both personal and surroundings. Practical solutions for avoiding single use plastics and alternate choices for plastic items etc. will also be offered. Dr. K.G. Sreejalekshmi, Dr. Ravi and Dr Mahesh along with Shri. Abdunnazar are coordinating the same.
3.	Basic Swachhta	1. General cleaning in the hostel was conducted under the supervision of Resident Faculty warden and AHMs/Wardens 2. All Heads of Departments organized a cleaning drive in their offices during the period from 03 to 08.02.2020. 3. Heads of Departments also identified broken furniture and other asset items which are in unserviceable condition in consultation with individual faculty members and staff of their respective departments. A comprehensive report of unserviceable items will be submitted to Registrar IIST and seek permission for condemnation of the same through Stores Division. A report on any surplus items available with individual faculty members/staff or in laboratories or class rooms will also be submitted to Registrar, IIST. 4. All departments have been advised to ensure minimal use of paper in their day to day work and issue strict instructions to all staff working with them. 5. Department of Chemistry will submit innovative methods of recycling paper within the campus and also identify agencies who will help convert used paper to recycled paper / folders /notebooks / vessels etc.

		6. Dustbins for segregation of waste is available in all the buildings and assortment of waste is already being done with suitable disposal. 7. Vermicompost pits for management of biodegradable waste generated in the campus is fully functional. 8. Biogas plant is also functional managing biodegradable waste as well as generating energy. 9. Fumigation and pest control measures are done according to well planned schedule. 10. E-waste generated in the institute are collected and stored with proper labeling in the Store of CSG. The procedure for proper disposal is underway.
	Advertisement	1. IIST website and social pages are updated Swachh Bharat Abhiyaan activities organized within and outside the campus. 2. It is proposed to display the Water Quality in the institute in the display board of Library. 3. It is planned to invite children from local schools for during the vacation period of the Institute and introduce them to the interesting works in our laboratories including our observatory which they can comprehend. IIST students are also to be involved in this activity. Short classes will also be arranged on hazards of waste and clean practices to make them aware of the need for a Swachh environment. The activity will be covered and uploaded in our social media pages as well as website.
	Water conservation	1. Intermittent water supply to avoid water wastage 2. Dual flushing system in toilets 3. Push cock flush 4. Combing water taps 5. Recycled water from STP 6. Sensor urinals 7. Rain water harvesting mechanism –helps acquire self sufficiency With regard to water requirement in the institute.
	Innovation	1. Indigenous Development of Reliable Gas Sensor Array for Different Applications (Report attached) – Dr. Palash Kumar Basu 2. Materials for remediation of water (Report attached) – Dr. K.Y.Sandhya 3. Integrated battery chargers for electric vehicles (Report attached) – Dr. R Sudharshan Kaarthik
	Awards	A Student Challenge Competition is being organized with key focus on innovative methods to promote Swachh environment 1. Innovative method /device to remove cob webs 2. Recycling of water 3. Tapping of rain water 4. Solutions to any other problem related to maintaining a clean campus including disposal of various kinds waste. A committee with Heads of Departments of Aerospace Engineering, Avionics and Chemistry will evaluate the same and recommend for prizes

Report of the FGD done in the Ayalkoottam(Neighbourhood Groups) on 16/2/2020 at 4.30 pm

No of women- 12
No of Research Scholars – 3
No of Staff -2

The group consisted of 12 women of the Ayalkoottam(Neighbourhood Groups). The women reported that their houses were either tiled, terraced or covered with asbestos and with cement floorings. They reported that their houses had gas stoves, water – pipe connections, tubelights & fans and TV. Their spouse had small business or were casual labourers. They had a small land holdings with houses constructed in the land . Children are sent to local government schools. For medical emergencies they consult local doctors and government Hospitals. Monthly earning might be between 10,000-15,000/-. Assessing the size of the families, it was found that almost all the families had 3-5 members, One of them had only two members who were the young couple and 2 had more than five members.

The ladies were asked about the intensity of Solid Waste management in the citiy of Trivandrum. According to them Solid Waste Management was one of the heated subjects for the public in the major urban centres of Kerala. According to the members, their major part of domestic waste consist of food waste and vegetable waste whereas the non-bio degradable parts mainly consisted of paper, plastic, metal and glass scrap. Since they did not have land to dispose the waste it is causing serious problem for them . The wastes are often thrown in the street or in the land of other houses. Food waste includes remains of vegetables, fruits, meats and other items . This leads to decay of waste items with increased pollution and environmental problems including the spread of diseases.

Ayalkoottam

The respondents are well aware of the negative effects of Plastics, the need for segregating waste, how waste can be recycled and other information on Solid Waste Management through TV, News papers and through Radio. Scientifically it has been proven that only 5% of the domestic waste needed be disposed, whereas the remaining 95% included compostable, recyclable and re-usable items. In a way, the 95% of waste were the

resources for the recovery of wealth from it. None of the women have started thinking of practicing at-house treatment of waste. They agreed that they have information about these practices from the programmes in the Television and newspaper, but none of them are practising it. None of the households were practicing proper segregation either by putting the waste into separate Bins or in Polythene covers or in card board containers. The Municipal Corporations in the cities of Trivandrum, Kochi and Kozhikode have provided two bins to each houses to segregate the waste at Household Level, which is not provided in Nedumanagad. Since the ban of plastics in the state, the use of plastics have come down in the area.

Regarding awareness about At-house treatment like Vermi composting, Bio Gas, Pipe composting and waste diversion, they have heard about at-house treatment, but they were not aware on the technical details. The issue that occurred at Vilappilsala, where the public protest led to the closure of the plant was a heated subject across the state covering the front pages of all print and electronic media for about two to three months in the year 2012. Some of them were aware about the Vilappilsala issue, while others were not. Many of them did not know where the collection points were or what materials could be taken there, or when. All these pointed towards the importance of frequent awareness methods to the public especially at Household level on the importance of waste handling, segregation of waste, issues associated with the improper handling of waste and more importantly the waste diversion either through at-house treatment of waste or alterative waste reduction strategies. Hence, a comprehensive discussion was carried out with the help of materials needs to create better Solid Waste Management practices.

This study recommends to provide complete awareness and a behaviour change communication system to induct segregation as a routine practice of households. It also insisted to have more of a monitoring part with public accountability and professional approach which could be taken up by IIST or with the help of Suchitwa mission.

IndigenousDevelopment of Reliable Gas Sensor Array for Different Applications

1. **Brief Description of Gas Sensor Activity:**

   The detection of various critical gases (carbon monoxide, hydrogen sulfide, nitrogen and sulfur oxide, ozone), with polluting effects in both indoor and outdoor air, are challenging due to their adverse effects on the environment. Even it is important to sense the gases in low concentration to avoid the risks toward human health and generalized damage to ecosystems. In addition, as greater amounts of oil organic compounds are currently being produced by applied construction materials and households, the number of people who develop various symptoms after moving into a new apartment (e.g., tickle, vertigo, headache, skin trouble) is increasing [6,7]. Hence, it is very important to detect those gases in early stages. The availability of gas sensors suitable for above mentioned activity is very limited. In this context, IIST is trying to investigate low weight, high performance nanostructure gas sensor array on low cost substrate at room temperature where each element of the array will be functionalized by required nano materials (metal Oxide with catalyst) to enhance the performance of the sensor.

2. **Achievements:**

   1. Successfully demonstrated reliable Hydrogen sensor for IPRC, Mahendragiri
   2. Developing gas sensors for Gaganyaan mission (Human Space Program)
   3. Successfully demonstrated reliable CH_4, NO_2,O_2 and CO_2 sensor
   4. An attempt is made to realize the gas sensor in integrated platform.

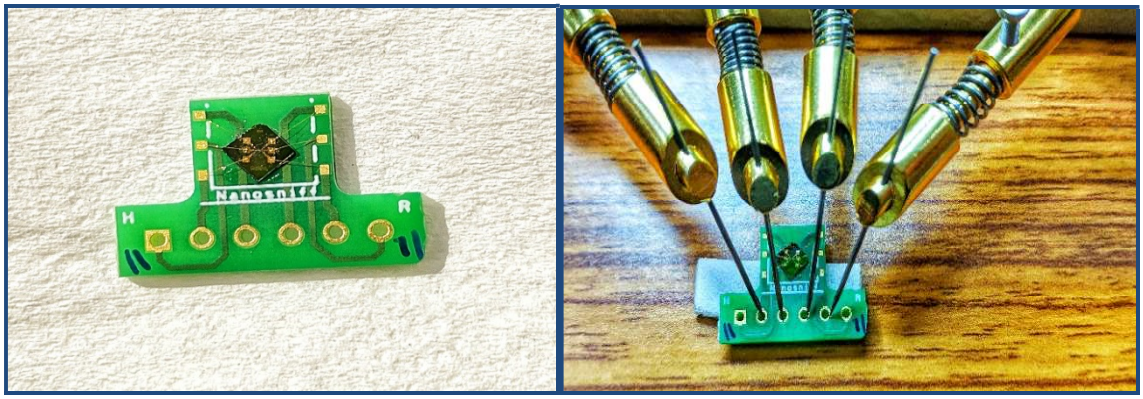
3. **Applications of Proposed Technology:**

   1. Low power and low cost Fuel leak detection (H_2, CH_4,O_2, NO_2etc) system
   2. Low power and Low cost on line Pollution monitoring system.
   3. Low power and low cost Green House Gas emission system from agriculture soil
   4. Low power and low cost Exhale breathe analyzer for Cardio Vascular Diseases.

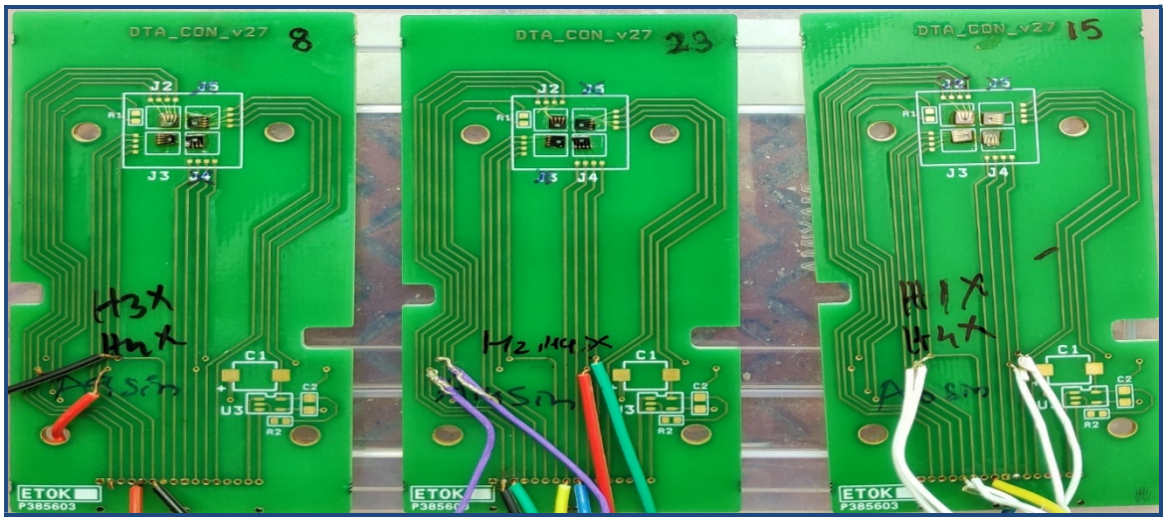
4. **Patents:**

1. “Reliable room temperature Gas Sensor with negligible baseline drift suitable at different air flow condition” L. Karthikeyan, Akshaya. M. V, **Palash Kumar Basu** [**Patent 2017: 201741027050**.]

5. Pictures:



(a) (b)



(c)

Figure: (a) microheater, (b) microheater while doing characterization, (c) array of microheater

6. Journals:

1. L. Karthikeyan, Akshaya. M. V, **Palash Kumar Basu** , *Reliable and Flow Independent Hydrogen Sensor based on Microwave assisted ZnO Nanospheres: Improved Sensing Performance under UV light at Room Temperature, IEEE Sensor, 18(2018)1810-1819.*

2. Reshmi Sreedharan, Akshaya M.V, BiswarupSatpati, Anupam Roy, **Palash Kumar Basu**, Kuntala Bhattacharjee, *Tailored MoS2 nanorods: A simple microwave assisted synthesis,* Materials Research Express, 4 (2017) 115012

3. Nivedita Basu, Anil Krishna Konduri, **Palash Kumar Basu**, Sandeep Keshavan, Manoj Varma, Flexible, *Label-Free DNA Sensor using Platinum oxide as the sensing element*, IEEE Sensor, 17 (2017) 6140-6147

4. Karthikeyan, Akshaya. M. V**, Palash Kumar Basu,** *Microwave assisted synthesis of ZnO and Pd-ZnO Nanospheres for UV Photodetecto*r,Sensors & Actuators: A. Physical, 264 (2017) 90-95

5. Samatha Benedict, **Palash Kumar Basu,** Navakanta Bhat, *Low power gas sensor array on flexible acetate substrate*,Journal of Micromechanics and Microengineering, 27 (2017)075024 (8pp)

6. **Palash Kumar Basu,** SangeethKallat, Samatha Benedict, Navakanta Bhat, *A Suspended Low Power Gas Sensor With In-plane Heater*, IEEE-Journal of Microelectromechanical Systems, 26 (2017) 48-50

7. **Palash Kumar Basu,** SangeethKallat, Anumol Ashok, Navakanta Bhat, *Suspended Core-ShellPt-PtOxNanostructurefor Ultrasensitive Hydrogen Gas Sensor,* Journal of Applied Physics**,** 117 (2015) 224501

Integrated Battery Chargers for Electric Vehicles

Need for Electric Vehicle Technology and Green Energy

Electric vehicle (EV) and hybrid electric vehicle (HEV) technologies are getting attention in industry and academia due to its positive impact on the environment. Increase in usage of electric vehicles results in cleaner environment because of the possibility to use green and cleaner sources of energy for transportation. This resulted in rapid research and development in areas such as permanent magnet synchronous motor drives, induction motor drives, battery technologies, wireless power transfer technologies, battery charging topologies and associated control algorithms.

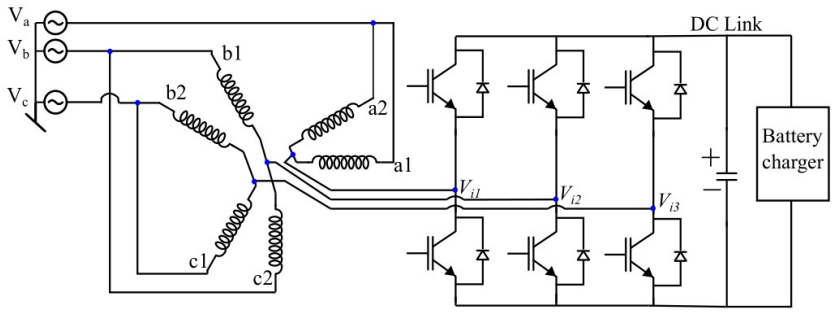
The recent trend is to move towards on-board chargers, which accelerates EV technology adoption as it addresses issues such as range-anxiety and lack of charging infrastructure. In typical on-board chargers, the entire charging and driving hardware is within the vehicle, with additional charging circuit resulting in increased vehicle weight, consuming larger space and higher cost and lower efficiency and reduced range.

Advantages

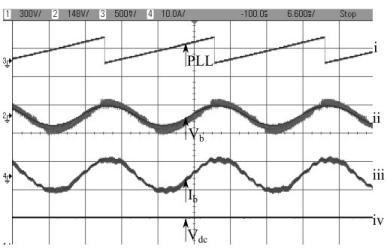
1) Existing 3-phase inverter (available in the vehicle) can be used
2) Existing 3-legged inverter can be reused
3) Possibility of retro-fit (reduced cost-to-change and market acceptance)
4) No brakes required during charging and produces zero mechanical vibration and noise while charging
5) Can be used for power-quality and energy security applications
6) Higher power handling capacity compared to existing on-board chargers – results in quick charging

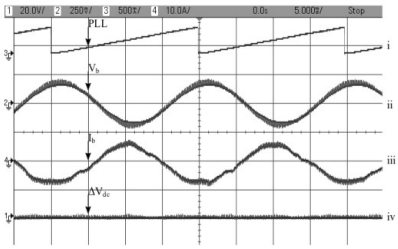
Applications of Proposed Technology:

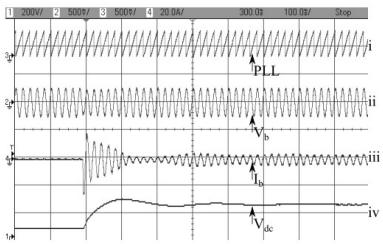
1) Three-phase Integrated Battery Chargers for high power EVs
2) Level-1 and level-2 charging for EVs
3) Level-1 charging with single phase grid with power decoupling
4) V2G and STATCOM operation is possible



(a) Proposed topology of the Integrated Battery Charger







(b) Charging mode (c) V2G mode (d) Transient performance

Related Publications

[1] Ranjith S, Vidya V and R. Sudharshan Kaarthik, "An Integrated EV Battery Charger With Retrofit Capability" in IEEE Transactions on Transportation Electrification (Accepted Feb 2020).

[2] Vidya V and R. Sudharshan Kaarthik, "A Control Scheme for Integrated Battery Charger With Split-Phase Machine," IEEE International Conference on Power Electronics, Smart Grid and Renewable Energy (PESGRE-2020), Kochi, India, Jan 2020.

[3] Vidya V, and R. Sudharshan Kaarthik, "Mathematical Modeling of Split Phase Machine based Integrated Battery Charger," IEEE International Conference on Transportation Electrification - 2019 (iTEC-2019), Bangalore, India, Dec 2019.

[4] Pragya Yadav, Vidya V, and R. Sudharshan Kaarthik, "A Voltage Sensor-less Single-Phase Unity Power Factor AC-DC Front-End Converter," IEEE International Conference on Transportation Electrification - 2019 (iTEC-2019), Bangalore, India, Dec 2019.

[5] S. Ranjith and R. Sudharshan Kaarthik, "An Integrated EV Battery Charger with Retrofit Capability," IECON 2018 - 44th Annual Conference of the IEEE Industrial Electronics Society, Washington, DC, 2018, pp. 5021-5026.

SWACHH BHARAT ABHIYAAN

COLONY VISIT REPORT

February 18, 2020

Place of visit: Valiayamala Colony (Ward 19, Nedumangad Municipality)
&
Paruthikuzhy region of Uzhamalaykkal Panchayat

Date of visit: February 16, 2020

Visiting team: Dr. V. J. Rajesh, Dr. Mahesh S
Haritha Anilkumar, Thesniya P.M, Anjumol K.S, Ravi Shankar S.S, Ruksana Salim, Lakshmi Mohan, Vangala Gayathri, Gaurav Kumar, Reema Mathew.

Aim of visit: To collect information about the living conditions of people, sanitation related activities and the mechanism of plastic and food waste disposal in the region.

Valiyamala Colony

The Valiyamala colony is a scheduled caste colony, but has now people of all castes living here. Even though it's named a colony, the living conditions here are far better than that of a slum area. All houses have electricity, water connection, toilets and septic tanks. Also, common panchayat wells are also present. There is a community hall here along with a library and a vignanwadi where computer classes are to be started soon.

Community hall

Waste disposal: There are no proper plastic waste disposal mechanisms. The people were informed that Municipality would collect the plastic waste but no steps regarding this are taken till now. So they burn plastic along with other paper and cloth waste. Food and other kitchen waste are dumped in pits or unused wells.

Burnt plastic along with other waste

Plastic heap

Health: For health related issues, people here mainly depend on Nedumangad Govt hospital. Twice in a month, a doctor and a nurse come in the community hall for checking blood pressure, sugar and cholesterol levels of people.

Education: There are many schools located nearby and school buses of all schools come here. But this is not reflected in the educational quality of the students. In fact dropping out from school particularly after 10th standard is prevalent here among boys. Karinga nursery school is shown below.

Vignan wadi

Problems faced by people: Water comes only twice in a week. During summer seasons, they face water shortage.

Influence of IIST and other ISRO institutions in Valiyamala on the lives of people here: Most of the people in the colony work in IIST or LPSC as daily wage workers or on a contract basis. This helps them earn a living. According to them, their living conditions have improved a lot after the setting up of these institutions here.

Panchayat Well

Paruthikuzhy area

This region comes under Uzhamalaykkal Panchayat. Compared to Valiyamala colony region, people here are more financially strong which is evident from the type of houses, except some which are in a very poor condition. A main road passes through here and therefore the region is well connected to other areas. Hospitals are present and a primary health centre, run by private parties is also there nearby. For drinking water purposes, Panchayat has constructed wells for houses.

The main issue found here too was the burning of plastic waste since Panchayat doesn't collect and dispose it. One thing to be noted is that the amount of plastic waste generation has decreased since it is banned in Trivandrum district. As said in the above case of Valiyamala colony, given a proper disposal mechanism is there, people are willing not to burn plastic.

Suggestions put forward

The main issue that was found in both the places was the burning of plastic waste. People are unaware about the health consequences of this. Being a thickly populated region, plastic burning in one area affects many people at a time. When they are asked not to burn plastic, they are ready to do that, provided there is some alternative for plastic waste disposal.

A request can be made to the Municipality authorities via the ward member of Valiyamala colony to have a proper plastic waste disposal mechanism. Waste bins can be placed at different points to collect plastic. This can later be taken by the Municipality.

Also, an awareness class regarding the need for proper waste disposal can be conducted.

Regarding drop out of students from school, this may be happening because they lack a vision in their life. A career guidance class may help to motivate them and introduce them to the world of opportunities.

Photos of the visit

The visiting team