Prof. M S Ananth Endowment Fund

In 2011, alumni of IIT Madras established the "Prof. M S Ananth Endowment Fund" in honour of Prof. M.S. Ananth who was retiring as Director that year. The interest from this fund is being used to provide financial assistance towards the school & college education for children of Self-Help-Group staff members working on campus and Socially Relevant Projects.

Socially Relevant Projects

The Socially Relevant Projects program, which started in the year 2003, with an initial grant of Rs. 10 lakhs from IIT Madras, is being supported by funds received from IIT Madras alumni.

In 2017, six projects were funded under this scheme for a period of one year.

S.No	Title of the Project	Project In charge	Amount (Rs in lakhs)
1	A Holistic Education Outreach to Inspire Transformational Change	Dr. Vijayalakshmi V, Dept. of Management Studies	2.50
2	Development of a system for assessment of onset of behavioural changes in children with autism spectrum disorder using surface electrodes	Dr. Ramakrishna S, Dept. of Applied Mechanics	2.75
3	Compact Robotic Vehicle (CRV) for Septic Tank and Sewer Line Inspection	Dr. Prabhu Rajagopal, Dept. of Mechanical Engineering	3.00
4	One Lab-One School	Dr. Pijush Ghosh, Dept. of Applied Mechanics	5.00
5	Property tax optimization for urban local bodies	Dr. Thillai Rajan A, Dept. of Management Studies	2.75
6	Publish science books at high school level in regional languages and donate them to village school libraries – Phase II	Dr. V Srinivasa Chakravarthy, Dept. of Biotechnology	3.70
		Total	**19.70**

Sep 25, 2017

IITM Campus Welfare Trust Owzone Project

In 2017, 52 children of the IITM campus Self-Help-Group staff, have been given support of their tuition fees totaling to Rs 9.97 lakhs through this scheme.

The details of the children including their contribution has been mentioned in the below list.

S.No.	Parents Name	Student Name	Class	Amount (Rs.)
1	Panneerselvam K S	Vedagiri P	BBA	30000
2	Prasad D	Sikamani P	VIII	11500
3	Raji M	Samuel R	V	14750
4	Srinivas P	Priyanka	VI	4750
5	Chenniah	Three V eethi Ramya Sree	IV	5000
		Jeevan Prasanth C	VI	
6	Balraj	Jeniffer B	I	47000
		Regina B	LKG	
7	S.Chandra	Mohanraj S	XII	2500
8	Satiyanarayanan	Nivedha S	II	47250
		Lakshithra S	UKG	
9	Mayakrishnan	Deepak M	IX	60000
		Deepika M	B.Com	
10	Chackravarthi	Angel C	II	22500
11	Narayanarao	Deekshitha B N	III	52250
		Hemnekhil B N	LKG	
12	Arullingam	Aravind A	II	29500
		Agastien A	LKG	
13	G.Lakshmi	Ramar G	XII	32500
		Saranya G	B.Com	
14	Machagandhi	Sridhar	XI	2500
15	K.Valli	Maruvarasi K	XI	2500
16	P.Mallika	Yugendran P	B.Com	24750
17	H.Kalaiselvi	Keerthika H	BE (Electronics)	30000
18	Amuda	Swathi A	V	36500

Sep 25, 2017

		Manikandan A	E C (Tech)	
19	Savithri K	Gokul K	IX	71750
		Bhanu Priya K	VIII	
		Bhagyalakshmi K	VIII	
20	S.Devi	Sangeetha S	B.Com	30000
21	Rajeswari	Swarnalakshmi P	IX	9500
		Matheswari P	VIII	
22	Kamakshi	Gokula Krishnan K	II	45250
		Sanjay K	V	
23	Mangai S	Jagadeesh S	VI	30000
24	K.Latha	Risha K	VII	89500
		Rigetha k	IV	
		Ayyanar K	II	
25	K.Chennarayudu	Balachandran C	BE (Mechanical)	30000
26	R.Sathya	Aarthi A	VII	60000
		Anand A	ITI (Auto)	
27	G.Magriet Mary	Joshva E	III	22750
28	K.Shanthi	Vinushya K	IV	59750
		Nithish Kumar K	II	
29	S.V.Narayani	Naresh S V	VIII	25500
		Rajeswari SV	XII	
		Krishnaveni SV	X	
30	Chennamma	Dhanush Kumar K	VIII	11500
31	Kasthuri	Madesh S	X	30000
32	J.Lakshmi	Monisha J	VI	23250
		Sandhiya J	IV	
33	Rukmani	Avinash L	IX	2500
				997000

Sep 25, 2017

Photos of Meeting with Student Beneficiaries and their Parents

Student Beneficiaries Photos

Avinash

Sandhiya

Manisha

Rajeswari

Madhesh

Dhanush Kumar

Krishnaveni

Naresh S V

Sep 25, 2017

Nithish Kumar

Shushya

Joshva

Anand

Ayyavu

Rigesh

Risha

Jagadeesh

Sanjay

Matheswari

Swarnalakshmi

Sangeetha

Bhagyalakshmi

Shanu Priya

Gokul

Swathi

Yugendran

Manuvarasi

Sidha

Saranya

Ramar

Agastion

Aravind

Hamnakhi

Three veethi

Samuel

Vedagiri

Aarthi

Deekshitha

Angel

Deepika

Deepak

Lakshithra

Niveetha

Mohanraj

Jeeven Prashanth

Sep 25, 2017

Keerthika

Manikandan A

Sikamani

Balachandran

Jenifer

Regina

Priyanka

Gokula Krishnan

For students Feedback and mark sheets please click:

http://alumni.iitm.ac.in/wp-content/uploads/2017/09/ms-ananth-2017-2018.pdf

Sep 25, 2017

Socially Relevant Projects (SRP) Program Funded In 2017-2018

The Socially Relevant Projects program, which started in the year 2003, with an initial grant of Rs. 10.0 lakhs from IIT Madras, is over the years being supported by funds received from IIT Madras alumni. In 2011, in honour of Prof. M.S. Ananth who was retiring as Director that year, the alumni of IIT Madras established the **Prof. M.S. Ananth Endowment Fund**. The interest from this fund is being used to fund projects under the SRP scheme.

In 2017-18, the following six projects are funded under this scheme.

Project Title: **Property tax optimization for urban local bodies**

Project Coordinator: **Dr. Thillai Rajan A, Dept. of Management Studies**

Amount Deployed: **Rs. 2,75,000/-**

Developments so far
1. Have created a full-stack software program that will store the back-end details on urban parameters
   a. Created this using the Java Script
2. A front-end interface was created to interact with the data and display of map based analytics at the front end.
   a. https://geohack.netlify.com/
3. We have created a deep-dive questionnaire. The questionnaire is optimized to integrate the usage and consumption of urban services.
4. Mobile survey app - The questionnaire was created as data collection software on a mobile based app. This app was based out of Open Data Kit data collection tool
5. Using the Mobile survey app, 164 data points were collected in the TNagar area. These points were based on observation and stakeholder interaction - The data collected will be used for validating the software with real time data
6. The idea was presented to 12 Urban Local Body stakeholders on March 27th 2018 in partnership with Administrative Staff College of India, Hyderabad

Geo Fulcrum – The Future of GIS Technology
for Smart City Planning

Steps taken so far and next steps

Building a data collection mobile app – Geo Fulcrum mobile app

3D images collected from International open portals. Building of image processing to automatically identify buildings from 3D stitched images - Algorithm

164 data points collected in T Nagar to support the tool. After interaction with local residents. Collected thru the Geo Fulcrum data collection app
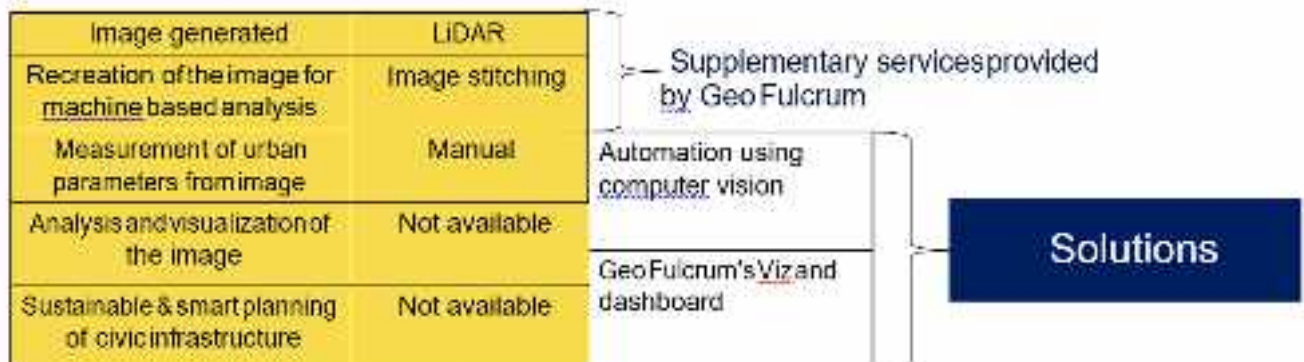
Geo Fulcrum web tool developed using Java Script to which the 164 data points collected so far will be uploaded

The Geo Fulcrum – web portal and the mobile was presented to 16 Urban Local Body Leaders at the ASCI

Geo Fulcrum will also be presented at the Frugal Innovation Summit – Raipur. Discussion on starting of a pilot will be initiated with the Raipur Govt.

Problem Statement

Take all of the data available in a living, breathing, thriving metropolitan city and use it to make a "digital twin" that can be researched, analyzed and manipulated in real time by multiple stakeholders.

Image generated	LiDAR
Recreation of the image for machine based analysis	Image stitching
Measurement of urban parameters from image	Manual
Analysis and visualization of the image	Not available
Sustainable & smart planning of civic infrastructure	Not available

Supplementary services provided by Geo Fulcrum

Automation using computer vision

Geo Fulcrum's Viz and dashboard

Solutions

Geo Fulcrum-Background

AP State Portal
Official portal of Andhra Pradesh Government

HOME   ABOUT AP ▾

A first in India: Chennai Corporation launches drone mapping of properties

When multiple cities in developing world are creating digital twin, *GeoFulcrum* will maximize the usability of the 3D image created.

Haryana to use drones to check illegal encroachments on govt properties

FEATURE STORY

Drones Offer Innovative Solution for Local Mapping

January 7, 2018

GeoFulcrum—a product of Civic Fulcrum aims to identify building and building dimensions from 3D and satellite images of cities.

Application areas
  Smart City Planning | Building violations | Property tax collection
  Optimization | Revenue generation | Prediction of future civic
  infrastructure needs

May 10, 2018

Conventional Urban Planning
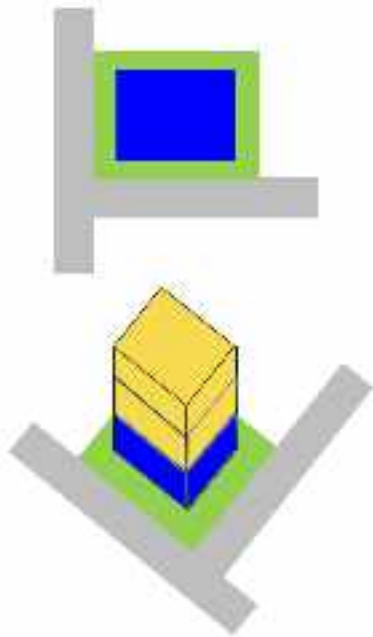
Urban planning demands a comprehensive understanding of issues related to horizontal and vertical expansions of cities

Most of the development plans prepared are two-dimensions (2D)

Limits the capability of assessing the provision of infrastructure Facilities for rapidly expanding urban area

Front End Dashboard

❖ Front end dashboard provides individual building level information that can be easily used by ULBs.

❖ Front end platform can be connected to internal database

❖ Platform can also integrates data from multiple sources like land use maps, city master plan

❖ Built by team using Java Script

Dashboard for use by municipality revenue officials

May 10, 2018
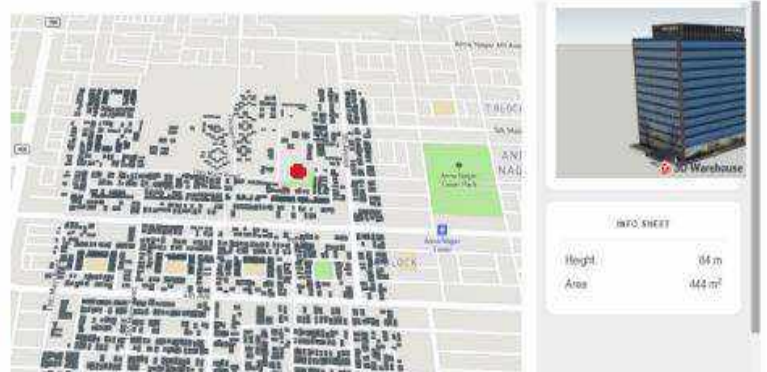
Methodology

Objective: Being future ready civic infrastructure and services – changing reactive measures to proactive planning

- Identification of study area
- Identification of land use in study area and examining regulations
- 2D Digitizing and creation of study area using Geo Fulcrum
- Conducting survey for capturing urban parameters; Buildings, transportation pattern, number of floors
- Integration of civic services data with buildings and HH
- Creation of information rich 3D map using Geo Fulcrum
- Volumetric analysis using 3D models created by Geo Fulcrum on civic infrastructure and services

Identification of study area

N
W ⊕ E   0   125   250   500 Meters ☐ Study_Area_Boundar
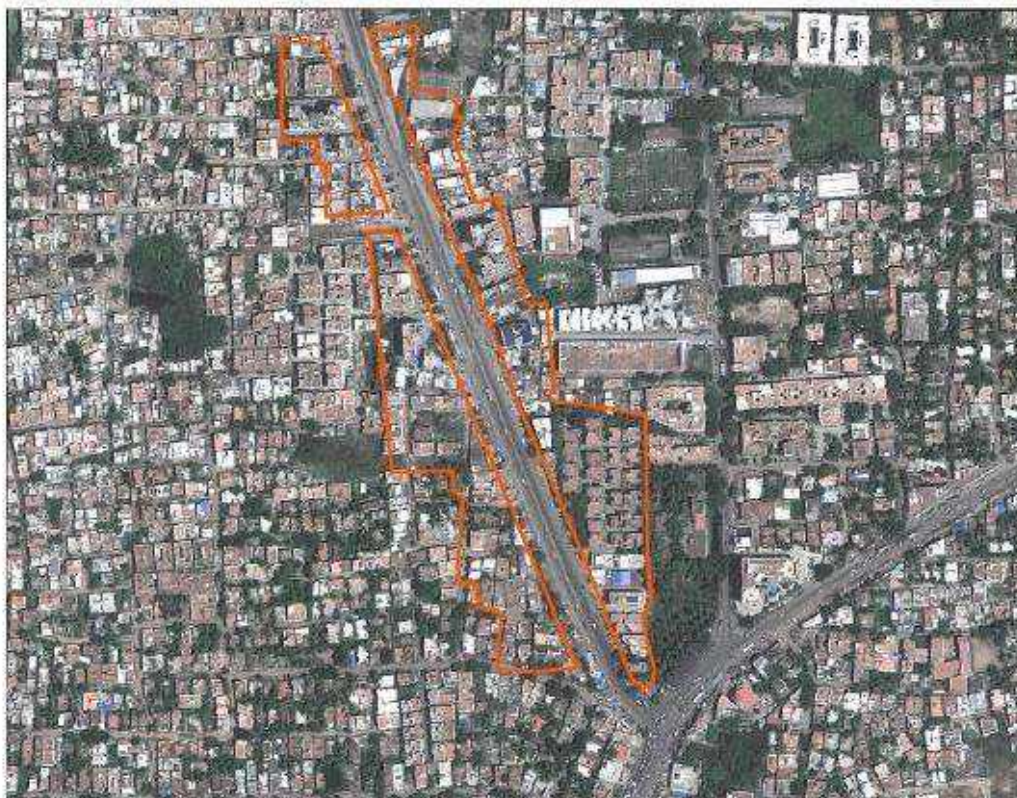
May 10, 2018

Identification of landuse in study area

2D Digitizing using Geo Fulcrum
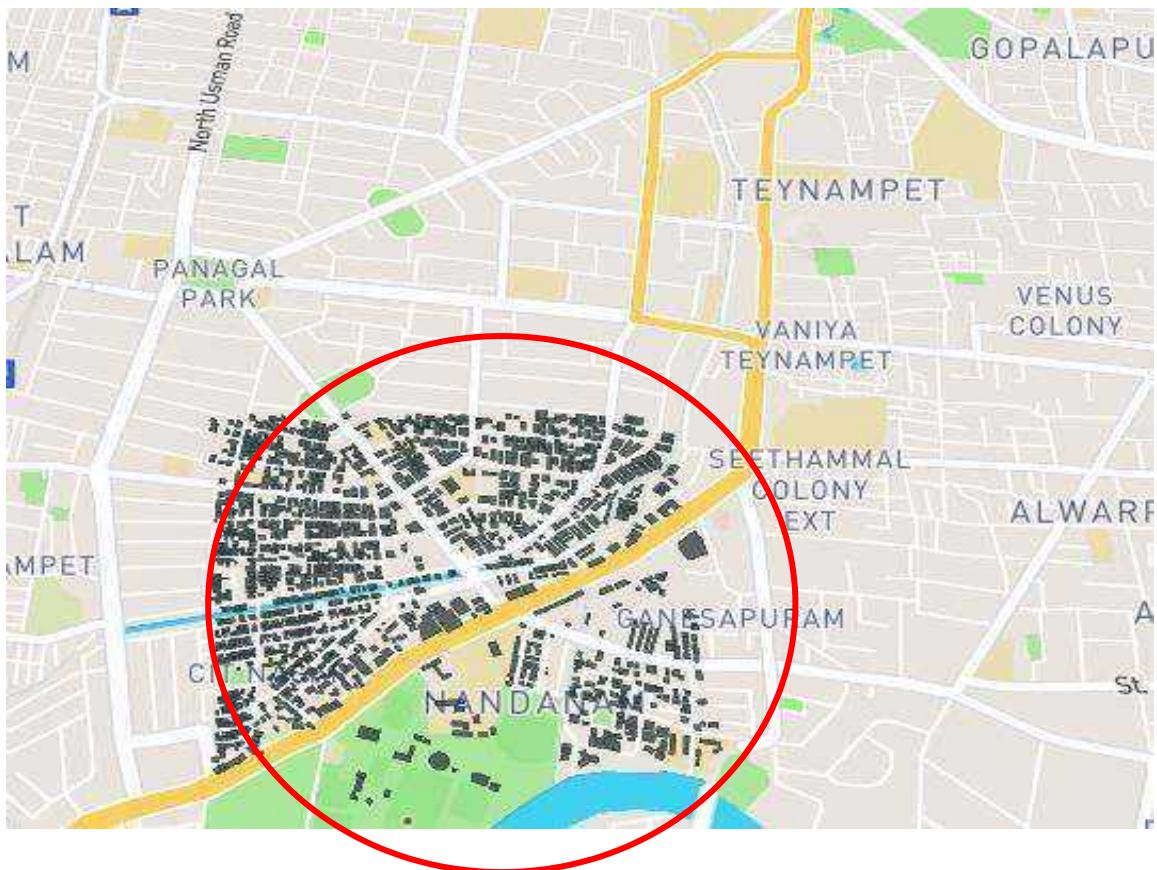
May 10, 2018

GeoFulcrum–Dashboard(Mapview)

2D–Field survey to capture urban

Built using Open Data Kit

200 data points collected so far from the T Nagar area

Geo Fulcrum – Dashboard (data representation) parameters

Water as an infrastructure

- Availability of water supply
- Frequency and duration of water supply
- Availability of wells/bores
- Dependency on corporation water

Transportation and commuting inside the city

- Work location
- Mode of transport
- Vehicle ownership
- Vehicle parking

Integration of data

- Civic services and infrastructure data
- 2D survey integration
- Enriching information
- Volumetric analysis and prediction on **GEO FULCRUM**

Results and Outputs

Total Water Demand-138600 lpcd

Current Water Demand 2013

This is only an illustration

Water Demand- 229680 lpcd

Senario 1 - Water Demand based on 2.5 FSI

Schemes for which this data can be useful

Working with Geo Fulcrum

Supported by IIT - Madras

Proof of concept and testing case
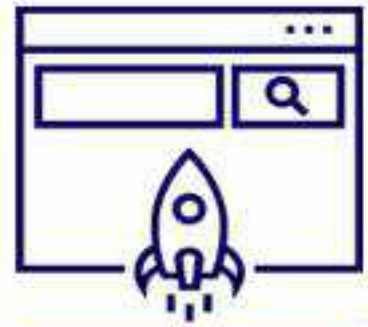
Launch Geo Fulcrum in your ULB

Core Team

Dr. Thillai Rajan Annamalai
Professor – IIT Madras
Department of Management Studies, IIT Madras
Infrastructure and Public Private Partnership

Anand Kumar
Project Officer
Geo Fulcrum – IIT Madras

Elayabharath Elango
UX Designer & Front-end developer
3D Modelling, Integrated Development
Environment National University of Singapore |
Autodesk

Nagappan Nachiappan
Software Developer & API Engineer
Developing and maintaining the API backend
and infrastructure providing access to the
database.

May 10, 2018

THINGS TO BE DONE:

1.   We will be presenting the idea and the pilot software at the Frugal Innovation Summit in Raipur, Chhattisgarh to be held between April 12 and 14, 2018

2. The total number of surveys collected to be extended to 400
3. A web based dashboard to display all the collected data points (descriptive and cumulative dashboards)

In line with the above mentioned points, we request for an extension of the project till End of July 2018. Thanks so much for your support and I hope you would consider our request favorably.

May 10, 2018

Feedback for Geo Fulcrum

Modern GIS Technology for Urban Infrastructure Governance

Name: UJJAWAL PORWAL

Position: Dy collector cum CID, State Urban Development Agency, Raipur (C.G)

Organisation/Municipality:

Contact number: 7747074733

Email address: UJJAWAL.PORWAL@gmail.com

Willingness to work on a proof of concept:

○ Yes

○ No

Kindly explain how Geo Fulcrum will be useful increasing your municipal service delivery

It will be very useful in planning & strateggize of the Urban management.

May 10, 2018

Project Title: **Publish science books at high school level in regional languages and donate them to village school libraries – Phase II**

Project Coordinator: **Dr. V Srinivasa Chakravarthy, Dept. of Biotechnology**

Amount Deployed: **Rs. 3,70,000/-**

1.   **Telugu Books**

Totally 4 new Telugu books were published as a part of this project.

The 4 titles are:

1. Srinivasa Ramanujan (expanded) – by VSC
2. Marie Curie – M. Krishna Prasad
3. Lokam chuttina veerulu (Stories of Explorers, Columbus, Vasco da Gama and Magellan) – by VSC
4. Rocket katha – by VSC
5. In addition one or two books left over from previous years were also sent

Copies of the above books were sent to 270 rural schools in Andhra Pradesh and Telangana states.

Books that were ordered:

Title	Unit price (Rs)	# of copies	Cost (Rs)
Srinivasa Ramanujan	60	500	30,000
Marie Curie	60	300	18,000
Lokam chuttina veerulu	100	300	30,000
Rocket katha	150	300	45,000
Total			1,23,000
Discount	40%		-49,200
Discounted total			73,800

May 10, 2018

The following book (Naa katha – Darwin's autobiography) was actually delivered last year. But at that time we ran out of money to pay the publisher. We paid the publisher for the copies (500) of that book this year.

Title	Unit price (Rs)	# of copies	Cost (Rs)
Naa katha - Darwin	60	500	30,000
Total			30,000
Discount	40%		-12,000
Discounted total			18,000

May 10, 2018
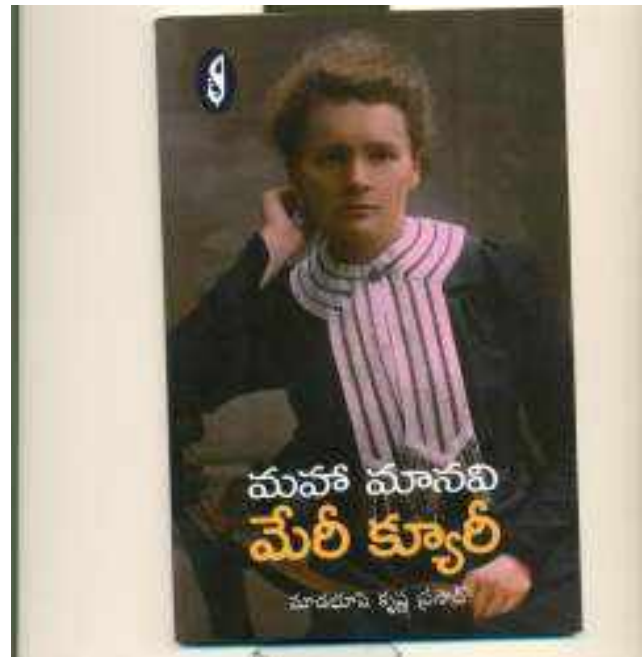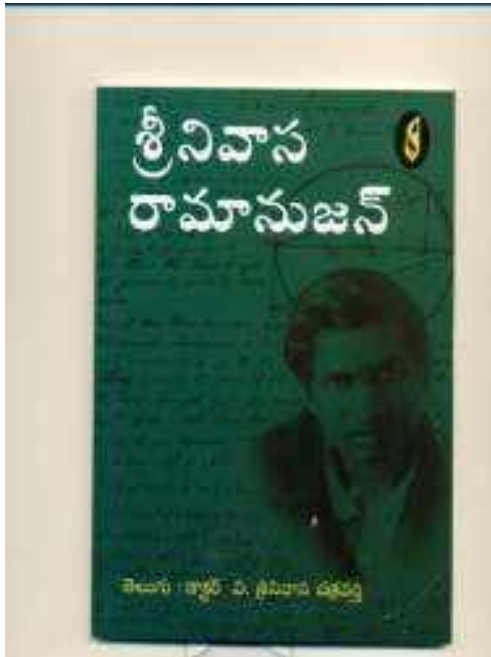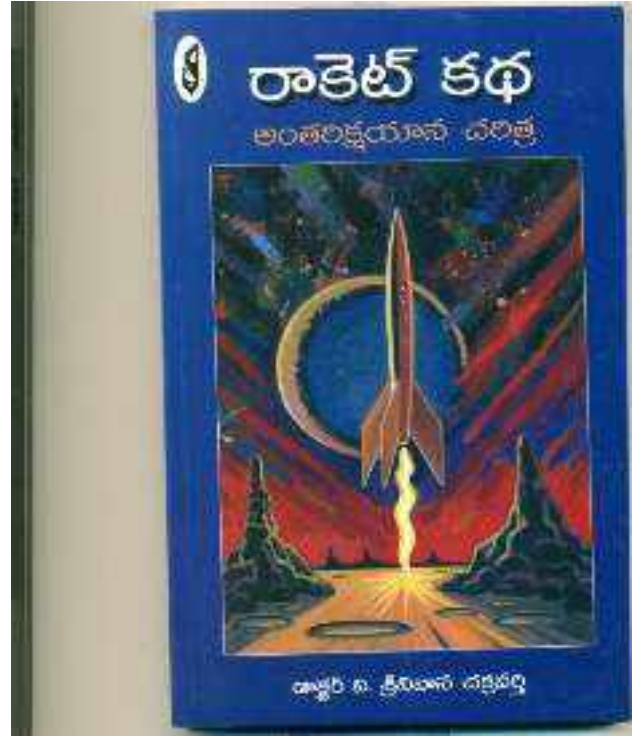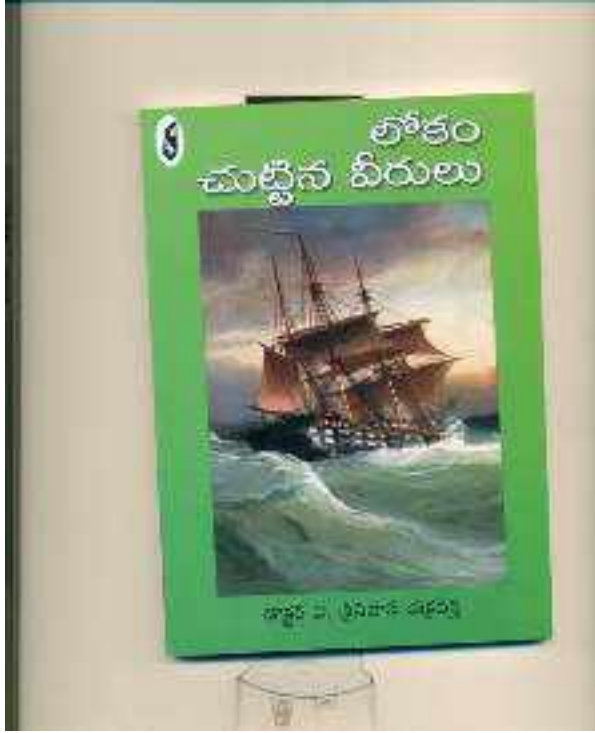
Totally 11 students have responded to these books and have written book reviews and sent them to us. We have sent those students personal copies of those books and a few extra books.

2.   Tamil Books

A set of 4 books from Isaac Asimov's 'How did we find out?' series was translated and published.

We ordered 300 copies of 4 Tamil science books for distribution

200 sets from the above 300 sets will be donated to Dr. Ravishankar Arunachalam of the NGO Chudar (www.chudar.org) for distribution and use within their educational centers. The remaining 100 sets are received by me. We will directly mail these copies to district libraries and some select schools

The 8 titles are:
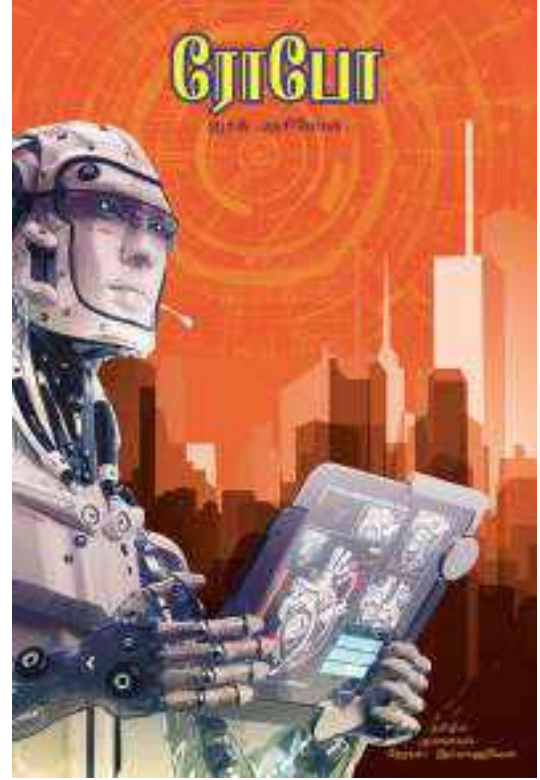
Sl.No.	TITLES OF THE BOOKS
1	Genes
2.	Outer Space
3.	Speed of Light (ஒளியின் வேகத்தை)
4	Robots

The cost of 4 books (300 sets):   Rs. 36,000
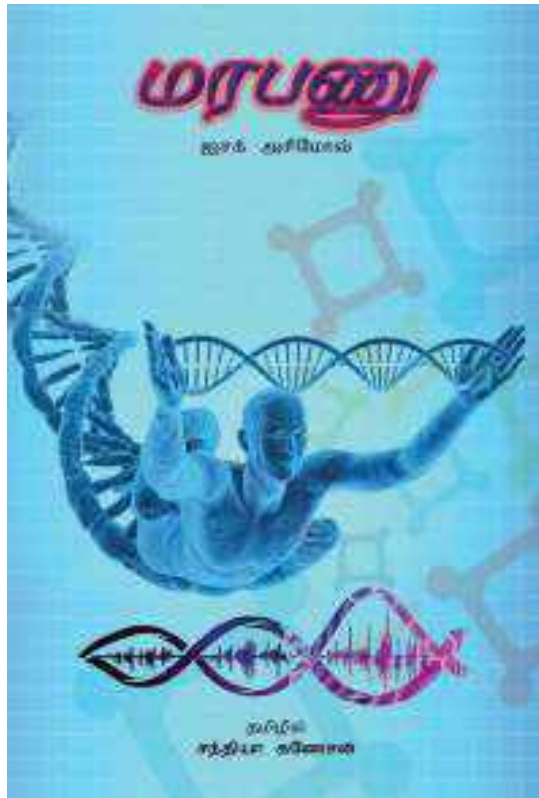
3. Kannada books

Four books of Asimov's How did we find out? Series was supposed to have been translated by a group of teachers in a school in Sargur, Karnataka. But recently their group leader stopped responding. So I don't know what the status is in this area.

May 10, 2018

Project Title: **A Holistic Education Outreach to Inspire Transformational Change**

Project Coordinator: **Dr. Vijayalakshimi V, Dept. of Management Studies**

Amount Deployed: **Rs. 2,50,000/-**

Holistic education promotes the holistic development and transformation of students (although the faculty, and the larger educational institution are also critical entities that need attention, this project focuses mainly on the youth). This proposal, therefore, aims to provide an applicable Holistic model of education that looks at the holistic development of the mind, vital life-force, body and soul of the high school student considering the need of true education (Telos, 2012; Manoj and Arul, 2011). The work proposed draws from a "inside out (inner guiding the outer personality)' and 'full rounded' approach to development through a holistic map of inner faculties.

Work done so far

Development of Humane Action (DHAN) Foundation has identified schools where the development work will be carried out. The first batch of 75 students is under way. These 7th standard students belong to Government High School, Sithalapakkam.

Phase 1 Pre-Workshop: Qualitative Analysis

Pre-workshop: The researcher had a small session to get to know the student and their demographic profile. The students are asked to respond the following questions those are

Q1. What is your life aspiration?

Based on a content analysis, it was observed that the students' life aspiration is unique. The most frequently occurring responses were CBI officer, police, IAS officer, Army officer, Teacher, Athlete, engineer, scientist, Doctor, drawing teacher and bank manager.

Q2. What are your strengths and areas of improvement?

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Good at: Sports (Running race, Kho Kho, Basket ball); Cultural activities; Arts and crafts, singing, dancing,

Need to improve: communication, overcome fear of public speaking, anger management, consistency in learning new things

Q3. If you are given a boon/power to change the world, what will you change?

- These were someresponses:
- Give support economically to the poor schools by providing quality education.
- Need to support the peers to study well like me: teach others what we know.
- Protect the nation from all the manmade disasters.
- Eradicate corruption
- Help the poor
- Invent new things that is sustainable
- Make India a litter free country
- Plant more trees
- Build new hospitals for the poor
- Continuously improve knowledge

Conceptual Framework

The research team of academicians, practitioners and educationists came up with a pilot framework called "to evolve" (Figure 1), based on feedback received from earlier workshops conducted for other schools (as part of other projects).

Figure 1: Research Conceptual Framework

Key Aspects of the Framework

The conceptual framework comprises of three focuses.

The outer circle being the contexts focused for holistic development. These contexts are to be kept in mind as contexts that influence the students and also contexts in which the students apply what they learn. The five contexts are Self, School, Family, Society and Nature.

The middle circle in the framework contain the tools used as medium for the learning. The same is outlined later in the pedagogy section.

The inner circle is the focus of holistic learning and development aimed at 4 areas of inner development – Physical, Emotion/ Energy, Mind and one's Deeper Self. Based on the holistic development model adopted for this project the four areas have been represented as eight parts of one's development (Manoj and Arul, 2011; Telos, 2012; Arul,2017; Instrengths, 2017), namely:

Physical

- Physical indicates the health of the body, the systematic development of the body aimed at its health and well-being. This is also the capacity to form and sustain conscious habits. A session on healthy, constructive habits kick started the program. Also, **Tai-Chi and Yoga program** were conducted for these children (see photos below). The students started journaling their thoughts, feelings and actions on a regular basis.

An Activity Depicting Healthy Habits

Tai-Chi Session

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The Emotion / Energy area

Emotional Freedom Technique (EFT) is a form of psychological acupressure, based on the same energy meridians used in traditional acupuncture to treat physical and emotional ailments for over 5,000 years, but without the invasiveness of needles. Instead, simple tapping with the fingertips is used to input kinetic energy onto specific meridians on the head and chest while you think about your specific problem — whether it is a traumatic event, an addiction, pain, etc. — and voice positive affirmations (https://eft.mercola.com/).

The Tamil Version of the Booklet Used for the EFT Session

The Mind area has three parts outlined as Data Mind, Creative Mind and Integrative Mind.
The session on Mind focused on puzzles, mind games, memory, and imparted deeper understanding as to how a subject like Maths, Physics, Chemistry can be studied appreciating its nuances.

A session on "Appreciating the nuances in Mathematics, Physics, Chemistry"

Deeper Self is the connection to one's inner self. Deeper self is the inner guide, the tiny voice and resonance within us that directs our evolution and inner development. It also points out our true inner nature.

A session on "Creative Expression, Harmony with One's Inner Nature"

Acknowledgements

We would like to acknowledge – the Team of academicians, practitioners, specialists who supported the design and delivery of the curriculum

- o DHAN Foundation Team
- o Headmasters and Teachers of the selected Schools
- o **Resource Persons:**
  - *Anto Vincent is an Independent Leadership Training Professional & Author. He is deeply committed and passionate to contribute to individuals through process of*

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personal counseling. Also, committed to empower youth through intensive training program. He is an Editor of a Wellness Magazine in Tamil. In addition, he acts as the Principal of a Community College, also coaches people on Wellness and holistic wellbeing.

o *Harshika Ramasubramanian is a Counselling Psychologist & Expressive Arts Facilitator. She constantly seeks opportunities to work in diverse settings and grow both personally and professionally. Being a passionate dancer, she also uses dance/creative movement in her work*
- therapy/training/both. Her work majorly revolves around children well-being and holistic development.

o *Niveditha Ramaratnam, Resources and Operations Executive, at DIRECT-A Child Development Institute, is an expressive arts therapist with over 15 years of experience in the field. She has worked in the capacity of a therapist, trainer, coordinator and program developer for various institutes across Chennai. She has developed several tailored training modules to foster growth and development of teaching and learning in rural/low-income communities. She has over 15 years of experience working with people with disabilities.*

o *Gopalakrishnan K did his Doctorate in the area of Knowledge Management at IIT Madras and is currently working in a leadership role at a global IT company. An avid learner and systems thinker, he is interested in sharing new perspectives of life to young children and see it transforming in them to be better individuals of society. He is passionate to share his knowledge, enable dialogue and inquiry into how we can live our lives more meaningfully.*

o *Padmavathy S is a veteran in the field of education with a Masters in Mathematics in I.I.T Kanpur and was a C.S.I.R Junior Research Fellow, for one year, at I.I.T. Kanpur. She has worked as a teacher at The School and Pathashaala – KFI for over 25 years. She has also collaborated with 'Sarva Shiksha Abyhan' for over 5 years on syllabus revision, curriculum, training of teachers and the like. An educator by passion and interest, she brings a child-like curiosity towards learning and loves exploring things.*

o *Arul Dev is the Founder CEO of People First Consultants, a human resource consulting firm since 1995. A holistic educator, coach and facilitator, discovers and teaches pathways of experiencing spiritual, purpose, value and potential fulfillment. He is a guest faculty at IIT Madras for the Self-Awareness, Integral Karma Yoga courses and the Self-Awareness and Higher Goals in Education (SAHGE) workshop for teachers and academicians and has been Integral Education workshops across States in India. He is the author of the Integral Inner Presence Model and uses the same in his workshops.*

o *Uma Narayanan is a facilitator, Coach and L & D Specialist is a Director at People First Consultants, leading their Learning & Organizational Development and Research Services, primarily on 'Integral Inner Presence' and 'Inner Strengths', which also forms part of her doctoral research at IITM. She uses the Life Fulfillment Coaching Methodology in her coaching and is a Certified Leadership and Life Coach from Coach for Life™. She is the co-author of the Instrengths Insight ™ and Profiling Tool and takes sessions of holistic development using Instrengths for students, teachers and corporates.*

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- *Colonel Jayakumar, Joint Registrar (Students, IITM) will carry out the Outbound training program after the children come from their vacation.*

- *V. Vijayalakshmi is a Faculty with the Department of Management Studies, IIT Madras. Her areas of interest include contemporary forms of teaching and learning, Ancient Indian Wisdom and principles of management. She has conducted several management and faculty development programs on themes such as 'nurturing the inner you', personal and professional development of teachers, students and corporates, self-awareness for IIT Madras (faculty, staff, and students), and several Integral education workshops for students and teachers across South India. She anchors other funded projects on holistic education and women empowerment.*

We also acknowledge the parents of these children – who understood that what is being done in the workshop is to allow the deeper potentials of the students, and they had complied with the design of the workshop and lent support at home to enable the journey for the students.

May 10, 2018

Project Title: **One Lab-One School**

Project Coordinator: **Dr. Pijush Ghosh, Dept. of Applied Mechanics**

Amount Deployed: **Rs. 5,00,000/-**

Objective

The objective of this proposal is, to develop a sustainable national level mentorship program where, graduate students and professors of different laboratories in elite institutions such as the IITs, NITs, etc., will mentor school students in rural and remote areas.

Methodology

The flow chart below shows the steps involved, following which each step in explained.

May 10, 2018
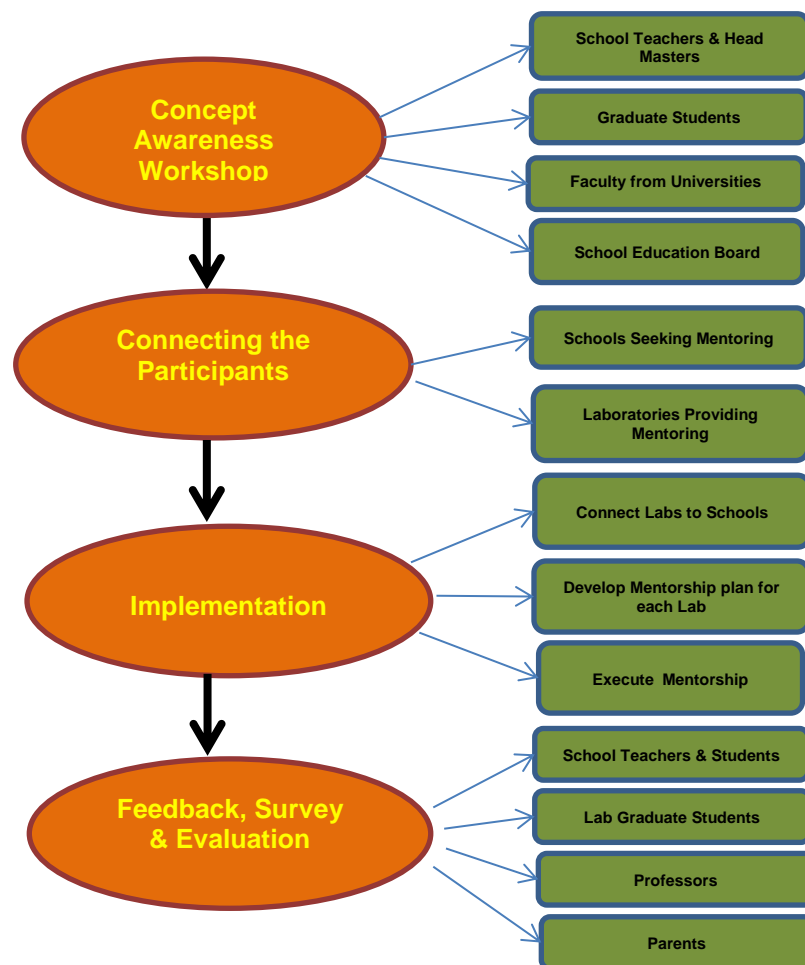
Progress

A)   Concept Awareness Workshop

School Teacher Workshop:

Date: January 2018

Venue: Research Park Seminar Hall

Attendees:

a)   100 school teachers from 50 schools of three districts- Thiruvallur, Kancheepuram and Vellore

b)   Rashtriya Madhyamik Siksha Abhiyan (RMSA) officials.

c)   Dean IAR, HOD Applied Mechanics

Agenda: Attached at the end.

Student Workshop

Date: 1st Meeting on January, 2018:

Attendees: Graduate students from different departments

Date: 2nd Meeting on February, 2018:

Attendees: Graduate students from the labs whose advisors expressed interest to participate in this program

Agenda: Explaining them the details about the program and other implementation detail

B)   Connecting the Participating Labs & Schools

I.   About 10-12 labs from IIT Madras ready to participate. Similar number of schools are identified from the schools attended the meeting

II.   We are about to take the list of the schools to the RMSA office for the official permission letter to be issued to the schools to participate.
C)   Implementation

I.   We are in the process of hiring project staffs.

II.   The resources necessary for the labs to visit the schools in terms of the devices, presentations etc are under preparation

III.   The school visits are going to start from 1st week of July.

C)   Implementation

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III. The school visits are going to start from 1st week of July.

1 Lab – 1 School': Meeting Agenda
11th January, 2018, IIT Madras Research Park

TIME	ACTIVITY
8:30am	Arrival & Registration
9:30am	Formal Inauguration of 1L – 1S
10:00am	Presentation of the concept in brief
10:30am	Tea & Snacks Break
11:00am	'1Lab – 1 School' in detail
12:00am	Group Interaction – to get input from schools
1:15pm	Lunch Break
2:15pm	Discussion – Group representatives present outcome of interaction.
3:30pm	Tea Break & Wrap up
4:00pm	Dismiss

May 10, 2018

Project Title:	**Compact Robotic Vehicle (CRV) for Septic Tank and Sewer Line Inspection**
Project Coordinator:	**Dr. Prabhu Rajagopal, Dept. of Mechanical Engineering**
Amount Deployed:	**Rs. 3,00,000/-**

Motivation

Manual scavenging (especially septic tanks) has been made illegal in India in 2013. Despite this, the practice is widespread in the country. Sewer workers often die due to suffocation, exposure to toxic gases that results in skin and breathing disorders. It's been reported as the most dangerous occupation killing at least 22000 workers every year. We intend to develop an affordable robotic vehicle to perform these tasks and eliminate manual scavenging

The current technology available (mostly in the US or European countries) in this sphere of robotics is limited to pipeline crawlers. These robots are compact, can crawl through pipelines and are accessed through manholes. However they cannot swim through water in the case of higher sewage volumes. Also from our discussions with Safai Karamchari Andolan [3] (an NGO fighting against manual scavenging), we realized there's no technology available for septic tanks, where the highest number of deaths are recorded in the country.

Lately, there has been extensive ongoing research in the field of underwater bio inspired propulsion at the Centre of Non Destructive Evaluation, IIT Madras. In order to combat the harsh sewage environment and enable locomotion in septic tanks, we aspired to implement a propulsion system mimicking fish and build a robotic vehicle that can swim through this environment and perform tasks such as cleaning and inspection

Here, we discuss the design and development of a robotic septic tank inspection system, whose key features include bio inspired propulsion, compact, modular design and high degree of maneuverability to minimize human intervention. The problems and constraints are explained along with the motivation for using alternate methods of propulsion, constrained locomotion and modularity for expanding the spectrum of inspections the robot can perform in the future.

May 10, 2018

Goals and objectives

Goal:

Design and fabricate an underwater remotely operated vehicle capable of carrying cleaning and inspection systems for septic tanks and possibility for extending to sewage lines. Refer to figure 1

Objectives:

- The main objective is to build an underwater compact robotic vehicle capable of navigating in all the 3 axis (x, y, z) and station keeping at a location desired underwater in sewage.

- High definition cameras provide live visual feedback enabling the operator on the outside to give commands through a joystick connected to the vehicle via wired cables.

- Additional clamps, ports and other provisions to enable modularity of the vehicle helping it carry various cleaning and inspections systems (auxiliary systems)

- A compact design limited by the size of the manholes for entry and a spark proof closed body configuration to eliminate interaction of any electrical and mechanical systems with the sewage
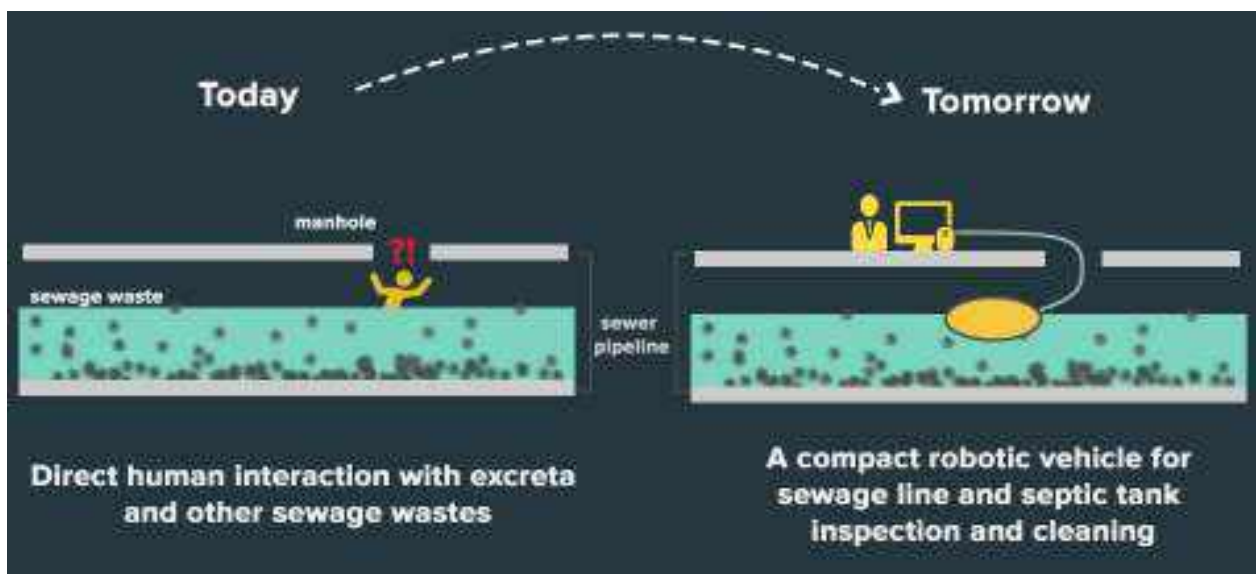

Figure 1: Schematic diagram representing the final goal of the project

- Incorporating principles of design for assembly, manufacture and maintenance to make the vehicle more customizable and user friendly

Work plan

- The project has three major problem statements(refer to figure 2) to be solved, with each of them having different sub phases(refer to figure 3)
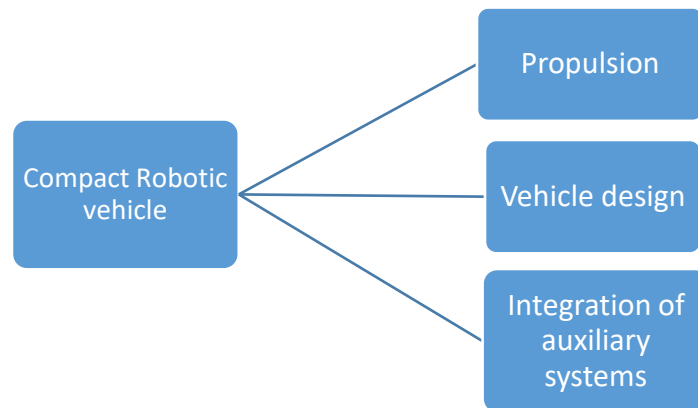

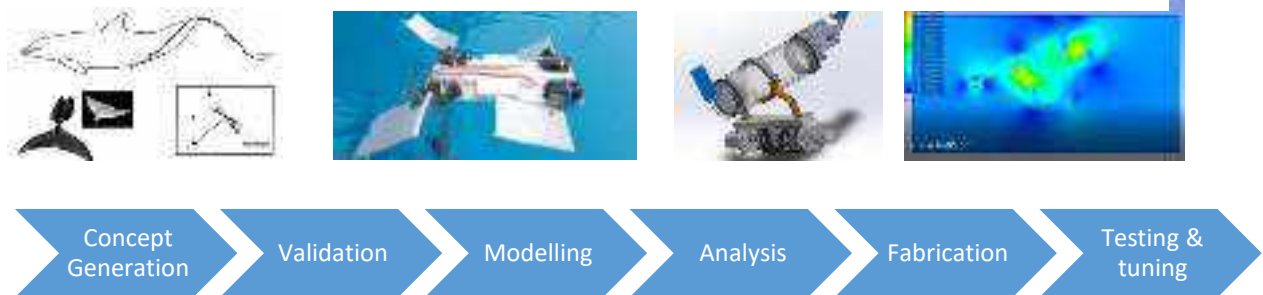Figure 2: Schematic representing the division of the problem statement

Concept Generation → Validation → Modelling → Analysis → Fabrication → Testing & tuning

Figure 3: Schematic representing the process of workflow in the design and development of the robot
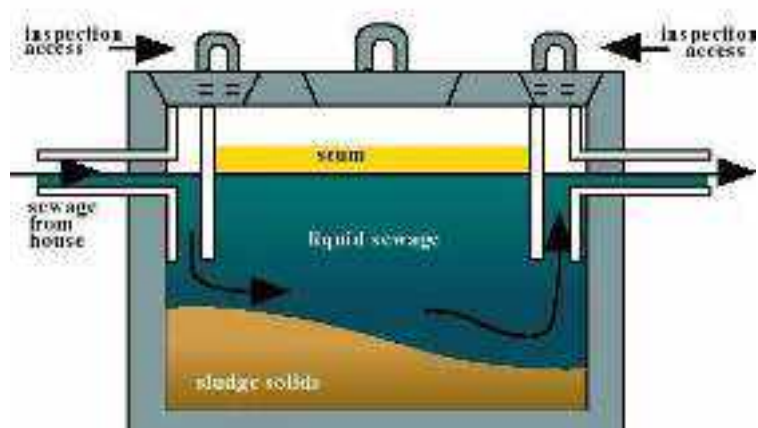
Understanding the septic tank environment

Figure 5: Schematic representing the different layers in a septic tank
Source: https://www.carlowtanks.ie

2018

The different constituents of the sewage that enter the septic tank separate in to different layers depending on their mass properties. The solid sludge settles at the bottom while the scum and other lighter waste material float on the top. Leaving liquid sewage separated in the middle layer whose density is very close to the density of water itself [6]. Most of the vehicle movement is through this layer and the tasks usually include

1. Breaking down the solid sludge into smaller pieces that can be pumped out with the water
2. Inspecting the walls of the tank without emptying the sewage water
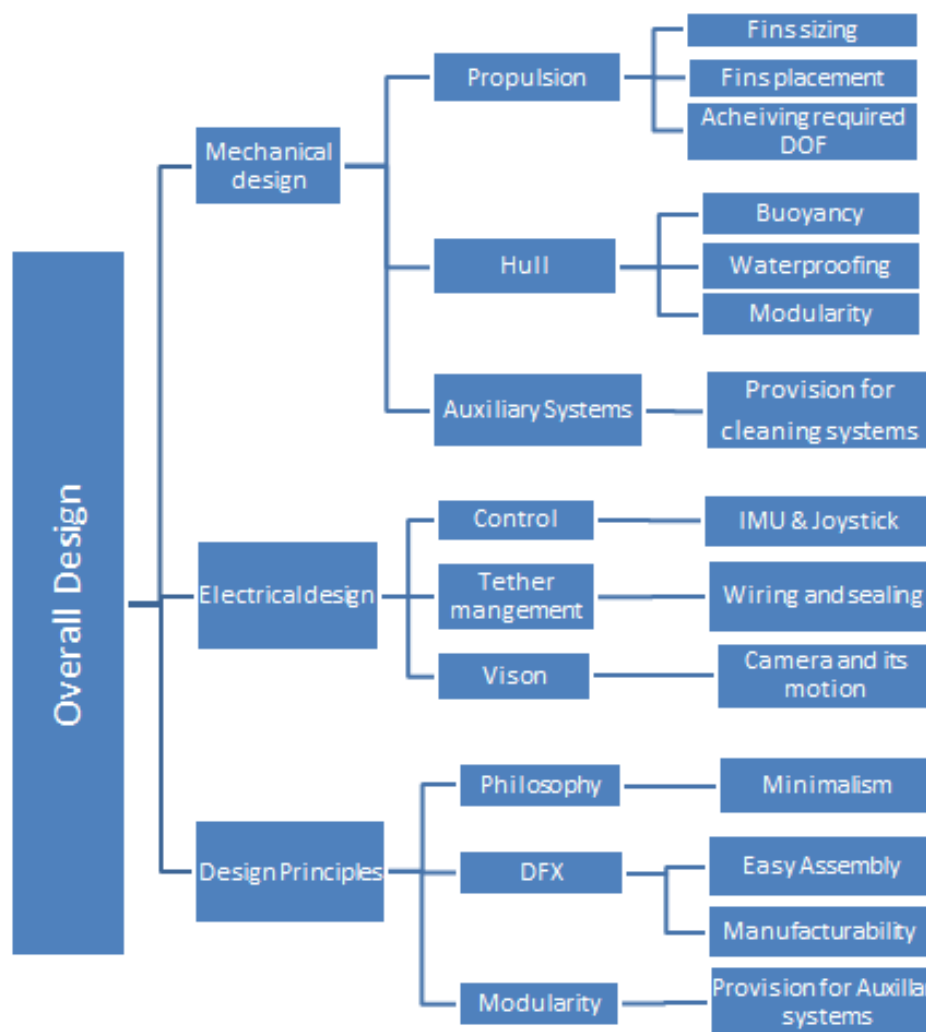
Design and development tasks

Figure 4: Schematic representing the division of the design and development tasks

Design constraints and Challenges

Propulsion

Conventional underwater ROVs make use of rotating propellers to provide the required thrust force. The suspended "particles" in the waste waters (refer to figure 5) make these

conventional underwater thrusters not feasible for usage. We intend to employ the in-house developed bio inspired fins for propulsion[4]. The thrust force is provided by flapping foils similar to how fish swim underwater.

Size Constraints

As per the Code of practice for septic tank installation in India[5] the opening to a septic tank should be not less than a circular opening of 500mm diameter or a rectangular opening of 455 x 610 mm. This imposes a direct constraint on the span width of the robot to be within 500mm

Maintainability and spark proof

The purpose of the project is to minimize if not eliminate the human interaction with sewage matter. The robot should be easily cleanable after it has completed an operation in the sewage waste with minimal human intervention. Hence an almost closed body configuration is needed so that there is no need for disassembly for cleaning and maintenance. Also the sewage environment contains a mixture of flammable gases and hence utmost care is to be taken to make the robot spark proof. This is also another reason to try and achieve a closed body configuration.

Station keeping and dynamic buoyancy

Due to the absence of the conventional underwater thrusters, station keeping becomes a major problem. There are various options available for station keeping or dynamic buoyancy like mass shifting, volume variance and more which will be explored in the further sections.

Waterproofing

The sewage water has suspended particles in a spectrum of sizes. Hence waterproofing using O-rings and having a lot of moving parts exposed to the sewage is to be avoided along with avoiding any kind of relative motion at the body water interface.

Proof of Concept (Stage 1 design testing)

Objective: To test the concept of four fin propulsion for complete maneuverability in the plane of the surface of water.

Setup and testing: A concept testing prototype from polypropylene was constructed. Motors were selected considering the drag force and fin size. The servos were controlled by an Arduino-UNO microcontroller.

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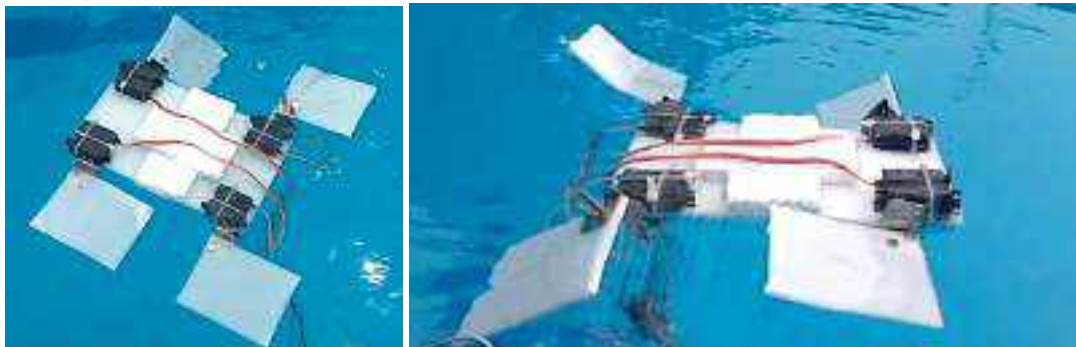
| (a) | (b) |

Figure 6 (a) The robot making a left turn by activating only the fins on the right side. (b) The robot moving forward with diagonally opposite fins in phase with each other

For better body dynamics, the fins diagonally opposite are set in phase motion. The thrust is produced when the fin is moving towards the mean position of oscillation (the plane of the water surface). Whereas drag is produced in the motion away from the mean position. Hence to lower this value of drag, this part of the oscillation has been given a lower frequency and hence lower drag. The prototype has been intentionally made positively buoyant, for recovery of the prototype in case of failure

Results:
1. The rotating moments have been produced as expected and sufficient in magnitude to make right or left turns.
2. The thrust produced wasn't enough to overcome any water currents that it faces
3. The electronics worked successfully as expected.

Design and development of Stage 2

From the results of the first prototype testing, the learnings are implemented in the second stage of the design.
Modifications:

1. Powerful motors - To face the currents and power a larger robot
2. Waterproof hull - To house the electronics and the motors

Figure 7 - 3D CAD model of the stage 2 prototype

New Additions
1. Scaling up - A step closer to the actual shape and size of the final product
2. Detachable shafts - For water proof motors and easy maintenance
3. Mass shifting mechanisms - For diving and resurfacing
4. Control systems - To establish a feedback system so that the robot does not deviate path
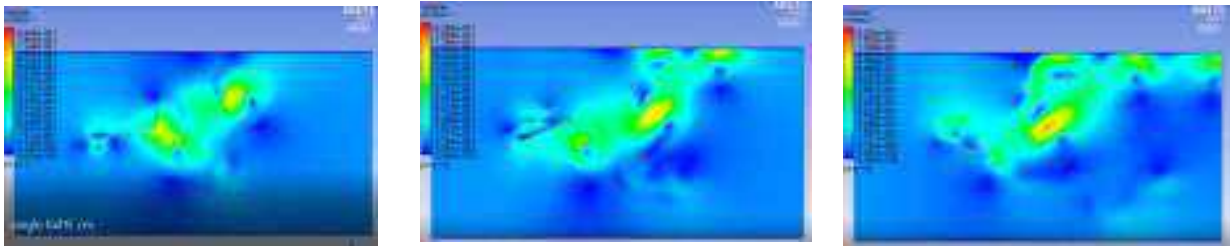
Analysis of the propulsion force from the fin:

Figure 8: Snapshots of the simulation of an oscillating fin in water moving at a velocity of
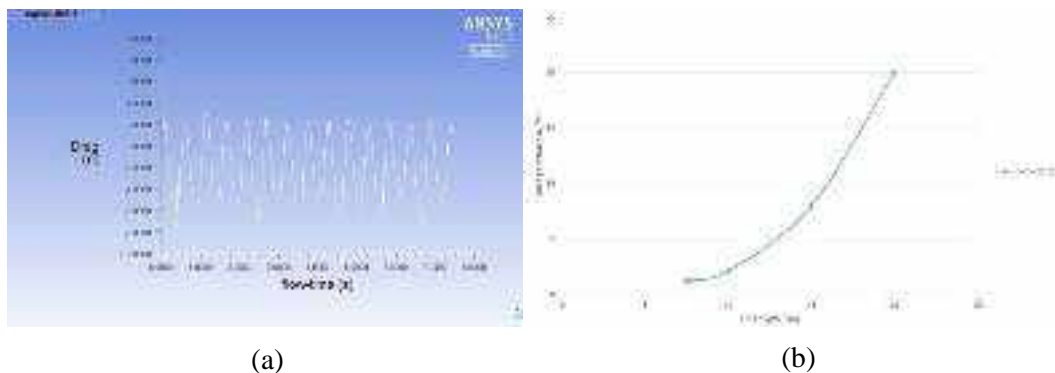

(a)   (b)

Figure 9: (a) Snapshot of the plot of force generated from a foil of 15cm length over multiple cycles of the oscillation. (b)Snapshot of the plot of the force generated with varying fin lengths

Simulations of an oscillating fin in moving water of 10 cm/s for different lengths of the fin have been performed on ANSYS Fluent. Following are the simulation parameters that have been used and manipulated to overcome convergence issues

- Mesh size : 6 e-3 m
- Time step : 0.002 s
- Number of time steps : 5000
- Oscillating frequency 1.2 Hz

From the data has been generated the fins of appropriate size which can generate enough force to overcome the drag and the inertia force have been selected for final design.

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Design and development of Stage 3

Keeping in mind the final functionality we realized that design for manufacturability and modularity is a key aspect that was missing in the previous design. Hence the following design changes were made.
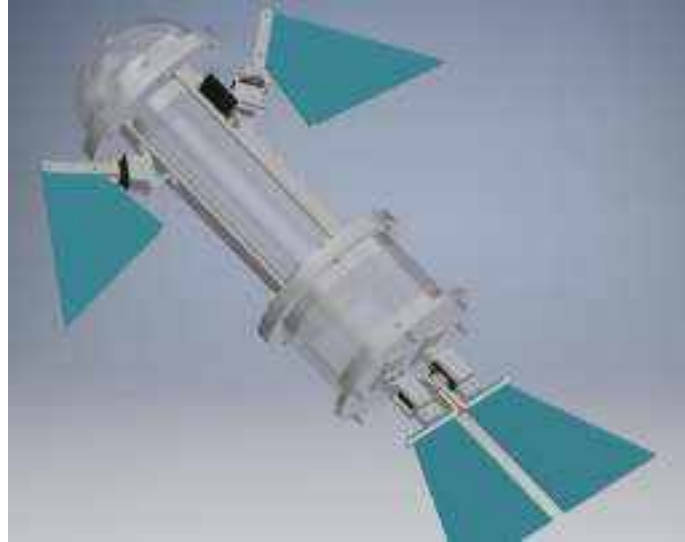

Figure 10: Snapshot of the 3D CAD model of stage

Modifications:

1. Use of a cylindrical hull to house the electronics and serve as the chasis support
2. Spherical face to minimize the hydrodynamic pressure drag
3. Modularity incorporated by adding beams around the hull on to which auxiliary systems for cleaning and inspection can be added
4. The span width of the robot has been brought down to less 45cm to comply with the manhole size constraints.
5. Fins orientation has been changed with an idea to get a uniform pressure wake area.
6. The single large tail fin has been split into two fins with independent actuators to reduce the motor weight (lesser capacity motors weigh lesser), hence bringing the center of mass of the robot closer to the center of buoyancy

Observations:
1. Large number of bolts present in the vehicle.
2. The beams that run around the hull might start bending when attached to complex auxiliary systems
3. Multiple hull compartments introduce new entry points for water leakage into the hull

Incorporating Minimalism- Current design stage

Multiple design changes have been made to the previous design in order to comply with our design philosophy of minimalism and DFX (X= assembly, manufacturability, modularity)

Figure 11: Snapshot of the 3D CAD model of the current stage of

Modifications:
1. The total number of fins has been reduced from 4 to 2, hence reducing the number of actuators required, resulting in a lower overall weight and power consumption
2. The multiple hull compartments have been removed and replaced by one single hull
3. The multiple bolted joints for the hull caps have been removed using an interference fit along with O rings
4. The beams around the hull which could have possibly taken a lot of stresses from the auxiliary systems are now replaced with C clamps
5. All the electronics are carefully housed inside the vehicle to make sure it is spark proof
6. Cameras have been added to enable visual feedback
7. A control system using an IMU's feedback has also been added
8. An input system through a joystick has been designed and integrated with the control system in order to make it convenient for the end user to operate the vehicle
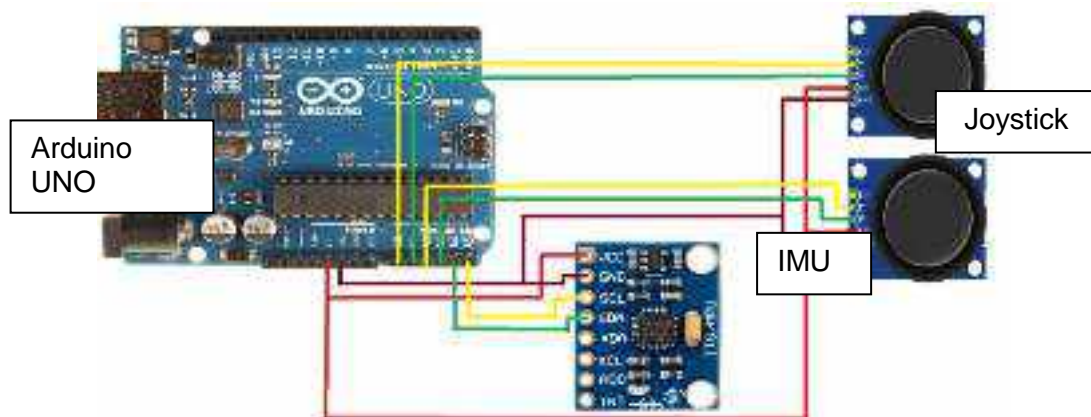
Control System:

Figure 12: Schematic showing the circuit diagram of the control

Manufacturing and Assembly

Figure 13: Picture of the robotic vehicle after final assembly

Materials Used
1. Acrylic – for the cylindrical hull
2. Polypropylene – For motor casing, shafts, caps and fins
3. Rubber -rings and oil seals for waterproofing
4. Aluminium – for the L- channels to hold the hold the electronics in place
5. Steel blocks – For lowering the center of mass from the center of buoyancy
6. The assembly has been completed and the testing of the robot is ongoing

May 10, 2018

Project Title: Development of a system for assessment of onset of behavioural changes in children with autism spectrum disorder using surface electrodes

Project Coordinator: Dr. Ramakrishna S, Dept. of Applied Mechanics

Amount Deployed: Rs. 2,75,000/-

Problem Description:

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder which leads to impairment in emotional and behavioral activities. Currently, no technology based objective evaluation tools are available to diagnosis and monitor autism affected children. Existing studies revealed the potential association between emotional changes and Electrodermal Activity (EDA) responses. The proposed work is development of and expert system based electrodermal activity monitoring system that can quantify the onset of behavior changes.

Objectives	Scope
- Design and development of signal acquisition system - Acquisition of physiological signals from ASD affected children - Development of expert system to identify behavioral change - Integration, Validation, Testing and Documentation	- Assessment and continuous monitoring of behavioral changes - Early Detection of behavioral changes - Human Resource development - Possibilities of Remote monitoring

Work done – Experimental setup and signal acquisition

Onset detection and quantification of emotional changes are begin EDA signal acquisition. ASD affected children who are the students of Swabodhini School for special children are the selected volunteers in this study. BIOPAC MP36 bio potential acquisition system is used to

record the EDA signal. Initially, the students are prepared by the team that consists of two biomedical engineering researchers, one special trainer and one psychologist. Then, electrodes are mounted for the selected volunteers and EDA signal is recorded under the regular ambient condition. Two recorded samples (5 minutes each) are depicted in Figure 2 in order to demonstrate the pattern of EDA signals at normal condition. Further, the recording protocol is designed.

Work done - EDA signal acquisition protocol

The major steps involved in an EDA signal acquisition protocol is given as follows:

- **Step 1:** Initial rest (5 min) (ii) Task load/Emotive stimuli (15 min) (iii) Rest (10 Min)
- **Step 2:** Setup control environment, ask volunteer to sit on chair for 5 min.
- **Step 3:** Record EDA signal when (i) listening audio sounds (ii) Displaying affective images

Each task can observe visual reaction time, color reading interference, fast counting, and working memory test. Five minutes task can achieve overall cognitive work load of 20 min
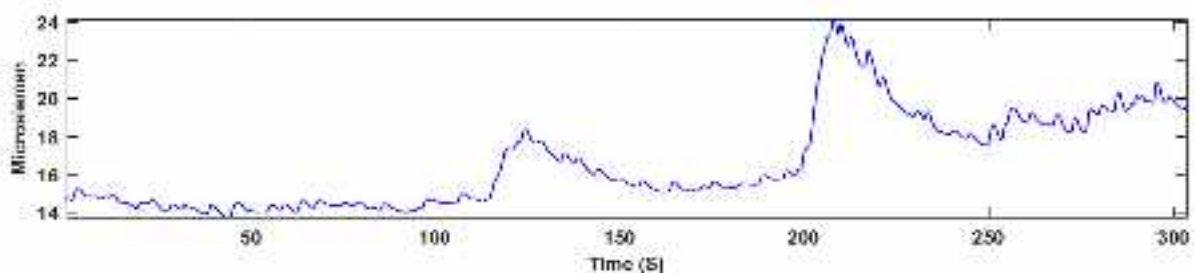
(a)
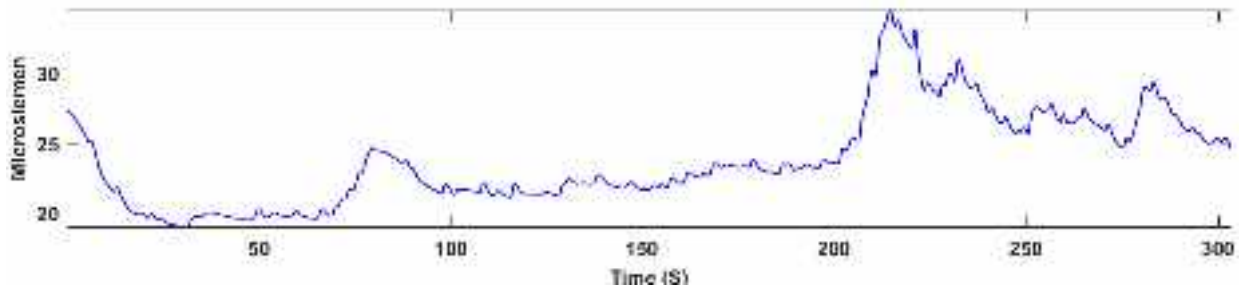
(b)

Figure 2. EDA signals of normal condition (no ambient environment control)

Current Ongoing Work

Prediction and onset detection of emotional and behavioral changes (EBC) using EDA signals is the vital challenge in diagnosis of ASD. Characterization of EBC can be categorized in terms of fear, anger, jealousy, joy, surprise, anger, disgust, etc. Signal processing methods such as time domain, frequency domain and joint time-frequency domain features are being developed to analyze EBC as (i) coordinated changes in feeling, expression, and physiological activation (ii) Quantitative estimate on the degree of emotional disturbance. In addition, feature selection algorithms, data reduction methods and statistical analysis methods are being associated with DSP techniques in order to achieve assessment of EBC with high accuracy.

May 10, 2018