SAMPAD BHUSAN MOHANTY

HOME ADDRESS

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WORK ADDRESS

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PERSONAL MOTIVATION

A self-learner, motivated by practical implementations and projects. I value hands on experience very much and I am always eager to put the learned theories into practical use in a project or in a fun experiment. I am curious to find opportunities that can emerge from embedded system, IOT, sensor networks, machine learning, robotics and related fields to help the industry, environment and the society. Being dissatisfied with the quality of education and method of teaching I was exposed to, in the long term, I want to see myself contributing to the technical education in India by making a career in both academics and industry so as to bridge industry, laboratory and classroom. I dream to do my higher studies from one of the top technical institutes in the world and remain a lifelong learner, teacher and leader, helping the academic and the industrial community.

CURRENT FOCUS

After working on various projects, in most of which, my journey has ended up after implementations of data acquisition over embedded systems, sensor networks, IoT devices; my short term goals are towards developing my skills in data analytics, machine learning and autonomous robotics. Also having worked in projects requiring practical deployments, lately, I am drawn more towards the theoretical aspects of these projects as I find the mathematics behind them quite fascinating. Limited by my lack of mathematical skills to tackle many problems I find interesting, I want to further my studies.

EDUCATION

National Institute of Technology, Rourkela
Dual Degree: B.Tech: Electrical Engineering — **2016**
M.Tech Specialization: Control and Automation
CGPA: 7.57

College Of Basic Science,
Orissa University of Agriculture And Technology,
Bhubaneswar Odisha
Intermediate/+2 Science/Higher Secondary Exam — **2010**
Percentage: 77.33

Kendriya Vidyalaya, Balasore
Odisha
Matriculation/Secondary School Exam — **2008**
Percentage: 89.8

ACHIEVEMENTS

Secured 3rd position in district level interschool Science Quiz — **2007**

CBSE Merit Certificate for scoring in top 0.1 percentile in the subject "Science and Technology" in All India Secondary School Examination-2008. — **2008**

All India Rank 95 in National Entrance Screening Test 2011, India — **2011**

(Out of approximately 1 Lakh test takers)

Medhabruti scholarship of 20,000 rupees per year from Department of Higher Education (DHE) Odisha – financial assistance to meritorious student's from economically backward families. **2012-2014**

Certificate of Appreciation from the director of Institute for excellence in Undergraduate level research project – NITR Balloon Satellite. **2015**

Among top 10 innovations in Intel Innovate for Digital India Challenge (IFDIC) for smartcity solutions product Aurassure- An air quality monitoring IoT solution we developed at PheonixRobotix during which I worked as the lead embedded developer for the product. Also bagged funding of **a million rupees** from Intel and Department of Science and Technology for furthering the product. **2015**

Nominated for Institute best M.Tech Project Award
(Project was already awarded best B.Tech Project Award in 2015)* **2016**

Nominated for Institute best Product Oriented M.Tech Project
(Project was already awarded best product oriented B.Tech Project in 2015)* **2016**

* The awards were awarded to my team mate Himanshu Sekhar Pradhan who started working on the project 3 months before I joined the team and graduated 3 months later with a bachelor's degree. The project was for a duration of 2 years and my work continued for the next 15 months which also became the basis for my master's thesis.

Received Best paper award for the paper -"A Reduced-Complexity, Reduced-Power Camera System for Intrusion Classification in an Outdoor Setting"
International Conference on Advances in Computing, Communications and Informatics (ICACCI), September 2017 **2017**

Received Best paper award for the paper -"Direction and gender classification using convolutional neural network for side-view images captured from a monitored trail"
at IEEE ICIIP, Shimla, December 2017 **2017**

Qualified and shortlisted for interview
in TIFR GS-2017 for PhD in Systems Sciences. **2017**
(among 47 other qualifiers for Computer and Systems Sciences)

EXPERIENCE

- **Project Associate, ECE Dept. Indian Institute of Science Bangalore (August 2016 – September 2017)**
  Worked on a low power sensor platform which uses Passive Infrared sensor array for intrusion detection and classification between human and animals like big cats. The sensor platform had to be low power and would be running from a solar energy harvesting system. Correlation between a pair of PIR sensors and the signal strength from 4 other PIR sensors were used as a feature vector and fed to an SVM running on a low power mote (Wismote and Zolertia Re-mote) to classify the intrusion as human or animal. Also developed light weight image processing techniques for Raspberry Pi Zero to complement the above platform at times of day when temperature gets close to body temperature of humans or animals, because PIR performs poorly in such environments. The work involved extracting features from video feed which are then fed to an SVM classifier to classify between the Human, Animal and vegetation. We achieved a frame rate of 8 fps on Raspberry Pi-Zero, 25 fps on an Orange Pi-Zero using an optimized version of the algorithm which provided accuracies of about 93%. An Odroid C2 was also deployed whose

frame rate was 25fps with a little heavier version of the algorithm for better accuracies reaching 97%. The work also involved comparison of various permutations of different image processing/feature extraction techniques like optical flow and machine learning models like decision trees, SVM and K- Nearest Neighbour based on their computational and energy efficiency while running on different Single Board Computers (SBCs) available like RPi2, RPi3, Odroid C2 and Orange Pi.

My role in the project spanned many areas including hardware, embedded systems, WSN, computer networking, image processing, signal processing and machine learning. On hardware end, I designing the signal conditioning multistage filter and amplifier for the PIR sensors and selecting the right ADCs. On the embedded aspect, my contribution was towards ADC interfacing of these sensors via I2C to a mote running Contiki-OS (Re-Mote). I also contributed in part to develop routines for extracting the energy and correlation features from the PIR signal sampled via the ADC in the ContikiOS. On the WSN side, I helped implement UDP client codes on ContikiOS for sending decisions from the Re-Mote to application server. I was completely responsible for developing the complementary camera platform. A few of my tasks were to implement optical flow using OpenCV, build various features from the optical flow vectors and implementing an SVM classifier which uses these features. Also included were tasks for optimizing the above systems for running on SBCs to obtain higher frame rates which lead to understanding of systems programming, IO bound vs CPU bound tasks and later coming up with a pipelined architecture for the optical camera using multithreading to address camera IO bottlenecks and comparison of effects of using various image filters on computation and accuracy of classification on these SBCs.
Keywords: OpenCV, Optical Flow, Image Processing on Multicore, Contiki-OS, Correlation, Background Subtraction, Support Vector Machine

- **Project Assistant, ECE Dept. National Institute of Technology Rourkela (June-July 2016)**
  Worked on extending my M.Tech project "Vehicle Monitoring in Open Cast Mines under Unreliable Cellular Network using ZigBee"**.** (More details under list of projects)
- **Research Assistant, ECE Dept. National Institute of Technology Rourkela (June-May 2016)**
- **Team Leader for Institute Balloon Satellite Project: NITR BALLOONSAT 2**. **(May 2014 - July 2015)**
- **Lead Embedded and Network Developer at PhoenixRobotix** (www.phoenixrobotix.com) **(2015-2016)**
- **Co-Founder of Nearthy.com, an online food ordering and delivery startup (July 2014)**

PUBLICATIONS

- Himansu Sekhar Pradhana,Sampad Bhusan Mohantyb,Santosh Madhukar Yermea,Paresh Govind Kaleb, Debiprasad Priyabrata Acharya, **"**Embedded System for mine process monitoring in a network constrained environment using wireless communication bridge", International Conference on Microwave, Optical and Communication Engineering (ICMOCE), IIT Bhubaneswar, 18th December 2015

  INTERNAL NOTE:
  My contributions to the above paper (Embedded System…) is about 80% including writing the paper, although I am not the first author.

  An efficient and robust implementation of a vehicle monitoring system in places where a Global Navigation Satellite System or GNSS (e.g. GPS, GLONASS, GALILEO) signal is available but Cellular Network Signal is unavailable/unreliable for making a GPRS connection like in an open cast mine is presented. A ZigBee Wireless Network is deployed at the location of interest, i.e. the open cast mine, with the ZigBee Network Coordinator attached to a Single Board Computer (SBC) which is placed at a remote place where it has uninterrupted Internet access either via LAN, Wi-Fi or Cellular Network (GPRS). The location of SBC is chosen such that the region devoid of cellular network falls within the ZigBee Coordinator's range. Other ZigBee nodes are attached to the vehicle's Tracking Equipment as ZigBee Routers. Whenever a vehicle's tracking equipment fails to make a GPRS connection, it sends its location via the ZigBee network to the coordinator which acts as a gateway and uploads the received location data to the tracking server. ZigBee Network Watchdog Timer are configured such as to allow automatic rejoining of ZigBee nodes when vehicles leave and enter the ZigBee Network Range. Vehicle tracking equipment and the Gateway Coordinating Equipment are implemented using hardware and open source software platforms and libraries such as Arduino, Raspberry-Pi and

Linux.

- Tarun Choubisa, Sampad B Mohanty, Mohan Kashyap, Shivangi Gambhir, Kodur Krishna Chaitanya, A Sridhar, P Vijay Kumar, "An Optical-Camera Complement to a PIR Sensor Array for Intrusion Detection and Classification in an Outdoor Environment", SenseApp - IEEE 42nd Conference on Local Computer Networks Workshops (LCN Workshops), Singapore, 9th October2017

  An important issue faced while employing Pyroelectric InfraRed (PIR) sensors in an outdoor Wireless Sensor Network (WSN) deployment for intrusion detection, is that the output of the PIR sensor can, as shown in a recent paper, degenerate into a weak and unpredictable signal when the background temperature is close to that of the intruder. The current paper explores the use of an optical camera as a complementary sensing modality in an outdoor WSN deployment to reliably handle such situations. A combination of background subtraction and the Lucas-Kanade optical-flow algorithms is used to classify between human and animal in an outdoor environment based on video data. The algorithms were developed keeping in mind the need for the camera to act when called upon, as a substitute for the PIR sensor by turning in comparable classification accuracies. All algorithms are implemented on a mote in the case of the PIR sensor array and on an Odroid single-board computer in the case of the optical camera. Three sets of experimental results are presented. The first set shows the optical-camera platform to turn in under supervised learning, high accuracy classification (in excess of 95%) comparable to that of the PIR sensor array. The second set of results correspond to an outdoor WSN deployment over a period of 7 days where similar accuracies are achieved. The final set also corresponds to a single-day outdoor WSN deployment and shows that the optical camera can act as a stand-in for the PIR sensor array when the ambient temperature conditions cause the PIR sensor to perform poorly.

- Tarun Choubisa, Sampad B. Mohanty, Mohan Kashyap, Kodur Krishna Chaitanya, Sridhar A, P. Vijay Kumar, Fellow, IEEE, "LITE: Light-based Intrusion deTection systEm Using an Optical-Camera and a Single Board Computer", LCN Demos Track, 42nd Annual IEEE Conference on Local Computer Networks, Singapore, 10th October 2017

  This demonstration shows the working of an optical camera-based system designed to distinguish between human and animal intrusion while rejecting clutter arising from wind-blown vegetation in an outdoor environment. The aim of the research was to use optical-camera system as a complementary sensing modality to a PIR sensor-based intrusion detection system. There are three important features to demonstrate: (a) the optical-camera based intrusion classification system using a Single Board Computer (SBC), (b) the algorithm which exploits the spatial resolution capability to help in classification, and (c) real-time demo of the visualization of features calculated and classification decisions.

- Tarun Choubisa, Sampad B. Mohanty, Kodur Krishna Chaitanya, Mohan Kashyap, Sridhar A, Akshay Singh P. Vijay Kumar, Fellow, IEEE,, "A reduced-complexity, reduced-power camera system for intrusion classification in an outdoor setting", International Conference on Advances in Computing, Communications and Informatics (ICACCI), Manipal Institute of Technology, September 2017
  (BEST PAPER AWARD)

  An optical camera was recently employed by a subset of the authors as a sensing modality complementary to that of a Pyroelectric InfraRed (PIR) sensor, for carrying out intrusion detection and classification in an outdoor environment. The aim there was to develop a classification algorithm that mimicked the performance of the PIR sensor and which was complementary to the PIR in the sense that it could carry out detection in environments where the PIR was unable to function effectively. An example of such a setting is when the ambient temperature is close to that of the human body. The algorithm for intrusion detection using the optical camera presented there, achieved an accuracy in excess of 95% and was implemented on an Odroid C2 (OC2) single-board computer (SBC). However, at 3.6W, the OC2 is relatively power hungry and this prompted the current effort to develop a version of the optical camera system that could be operated at a reduced power level. The power-reduction techniques considered here include examining

alternative SBCs such as the Orange Pi Zero (OPiZ), developing reduced-complexity intrusion-detection algorithms that permit a reduction in power consumed through a commensurate reduction in CPU clock speed, operating with a single CPU core and reducing power consumption by peripherals. Reduction in computational complexity was achieved by working with a reduced image resolution, a smaller Lucas-Kanade window, identifying and deleting power-consuming steps that did not contribute appreciably to classifier performance as well as removing portions of the code used for understanding and debugging. The resultant reduced-complexity algorithm, implemented on an OPiZ, turned in performance comparable to that of the high-complexity algorithm at a reduced power consumption of 1.3W. In most instances, classification accuracies obtained on recorded data were in excess of 95%. An outdoor deployment was also carried out in which 1.23% missed intrusion detections, 2.22% intrusion misclassifications, and 1.72% false alarms were observed.

- Tarun Choubisa, Mohan Kashyap, Sampad B. Mohanty, P. Vijay Kumar, Fellow, IEEE, "Comparing chirplet-based classification with alternate feature-extraction approaches for outdoor intrusion detection using a PIR sensor platform", International Conference on Advances in Computing, Communications and Informatics (ICACCI), Manipal Institute of Technology, September 2017

  Prior work by a subset of the authors led to the development of a Pyroelectric Infrared (PIR) sensor platform for the purposes of distinguishing in an outdoor environment, between human and animal intrusion while rejecting false alarms arising from wind-blown vegetation. The algorithm employed there, modeled the intrusion signal as a linear combination of chirplets. The extracted chirplet-based features were fed to Support Vector Machine (SVM) for the classification. This resulted in a platform that, under the tested conditions, resulted in high classification accuracy, in excess of 95%. The current paper is aimed at determining the extent to which the classification accuracy could be attributed to the use of the algorithm employed. Fifteen different algorithms for intrusion detection and classification are examined in the current paper, these operate on a database that builds on top of the earlier database. These fifteen algorithms correspond to the different possible pairings obtained by selecting from among 5 feature-vectors and 3 classifiers. The results show that the chirplet-based feature extractor to play a major role in achieving high-accuracy classification, easily beating the performance of the other feature extractors, particularly in terms of the more challenging task of separating intrusion from vegetative clutter. The two principal conclusions that can perhaps be drawn here are that (a) chirplet-decomposition can be a very effective feature-extractor in the case of a PIR signal and (b) it is important to incorporate domain knowledge where possible in designing the most effective classification algorithms.

- Tarun Choubisa, Mohan Kashyap, RN Rithesh, Sampad B Mohanty, "Direction and gender classification using convolutional neural network for side-view images captured from a monitored trail", Fourth International Conference on Image Information Processing (IEEE ICIIP), Shimla, December 2017 **[BEST PAPER AWARD]**

  Prior work by a subset of authors led to a development of optical camera platform, which has a capability of distinguishing between human and animal movement in an outdoor environment. Once the image is classified as a human, an idea of providing additional information and insights led to the exploration of gender (men vs women) and direction (left to right vs right to left) classifications. The proposed method classifies the human gender, based on the full body image oriented in a side view manner. An additional feature is to classify the direction of the movement. In the current paper, the Convolutional Neural Networks (CNNs) are used to distinguish between men and women gender classes and to identify the direction of the movement. Furthermore, different aspects of CNN are visualized (for example, attention heat maps, t-Distributed Stochastic Neighbor Embedding plot, etc.) to provide useful insights corresponding to classifications and misclassifications. Additionally, different CNN architectures were tried to figure out the best possible choice. The classification accuracies for gender (men vs women) and direction classification (left to right vs right to left) on the test data are close to 93.3% and 94%, respectively.

- Neha Karanjkar∗, Ashish Joglekar, Sampad Mohanty, Venkatesh Prabhu, D. Raghunath and Rajesh Sundaresan, "Digital Twin for Energy Optimization in an SMT-PCB Assembly Line", "Digital Twin for Energy Optimization in an SMT-PCB Assembly Line", International Conference on Internet of Things and Intelligence System (IEEE IoTaIS) Bali, Indonesia November 2018

TALKS AND DEMOS

- Invited for a talk and demo on "Development of an Optical Camera based Intrusion detection and monitoring system" IoT Workshop, Dept. of ECE, NIT Rourkela [19th August, 2017]
- LITE: Light-based Intrusion deTection systEm Using an Optical-Camera and a Single Board Computer", LCN Demos Track, IEEE LCN, Singapore, October 2017

CAMPS/TRAININGS/WORKSHOPS ATTENDED

- **Physics of Life,** 5th Annual Simons-NCBS Monsoon School **[NCBS Bangalore]** (18th – 24th June 2017)
- Odisha Power Transmission Corporation Limited (OPTCL) (Winter 2013)
- Training on Advanced Embedded Systems at Central Tools and Training Centre, Bhubaneswar (summer, 2013)
- Basic JAVA at LAKSHYA Training (Authorized Training Centre for C-DAC, Bhubaneswar) (Summer 2013)
- RC Glider workshop NITR (2012)

PROJECTS

INSTITUTE PROJECTS

- **Institute Balloon Satellite: NITR BALLOONSAT** (Summer 2014)
  Head of software team containing 4 members where we developed software for Onboard Controller, Base Station and Communication for remote actuation of parachute and air quality data telemetry in real-time for a Balloon Satellite. The payload which weighed 1200g had sensors for measuring suspended particulate matter, various gases like CO_2, NO_2, SO_2, Ozone and CO along with temperature, humidity, pressure and GPS. A Digi XTend 900MHz RF module was used to communicate the telemetry data to the ground station in addition to logging it in a local SD card. It also contained a GPRS modem to track the balloon after landing if RF communication failed. The balloon was launched in November 2014 and reached a height of 2 Km. We successfully acquired the relevant data and also recovered the payload after return to ground.
  (Prof. Samit Ari and Prof. Ajit Kumar Sahoo – Dept. of Electronics and Communication Engineering, NIT Rourkela).

- **Hybrid Electric Bike** (Winter 2014)
  The project was to convert a regular scooter motor bike into a hybrid electric bike running off both battery and petrol. I interfaced the electronic throttle position encoder with an Arduino board to read ADC value which was then communicated to a Raspberry Pi single board computer over UART where a control algorithm calculated the PWM values for the electronic speed controller (ESC) of the front wheel's Electric drive and for the servo motor of the throttle valve for the petrol engine which were communicated back to another Arduino to generate PWM for driving the ESC and the servo.
  (Prof. Bidyadhar Subudhi, Dept. of Electrical Engineering, NIT Rourkela)

- **Intelligent Ground Vehicle** (Winter 2014)
  Interfaced ultrasonic sensors and speed encoders for the IGV. Also developed codes for telemetry of the acquired sensor data to a Raspberry Pi 2 computer for environment map generation using Python.
  (Prof. Pankaj Kumar Sha - Dept. of Computer Science, NIT Rourkela).

- **Air Quality Sensor Network for Monitoring Air Pollution** (March-April 2015)
  Inspired by **CLAIRITY project – MIT** (http://clairity.mit.edu/site/html/)
  This was a project we (2 seniors, me(junior) and 2 sophomores) pitched for to a team of professors from IIT Delhi and secured a grant of Rs 100,000 for the same. I was the technical lead for the project and developed embedded code for

the Air Quality Sensor Hardware Platform which included interfacing a variety of gas sensors, particulate matter sensor (from the leading company Alphasense Sensors Inc.), temperature and humidity and pressure sensors. It also involved interfacing a GSM/GPRS modem to collect data over a cloud computer and a ZigBee module to collect data over a local ZigBee network. This hardware was latter converted into a product called AURASSURE (http://aurassure.com) by the IoT startup PhoenixRobotix (https://phoenixrobotix.com)

- **Team Leader for Institute Balloon Satellite: NITR BALLOONSAT 2**. (May 2014 - July 2015)
  Headed a team of 10 active members to develop the onboard computer, telemetry and sever side software (using Python, and Node.js). The satellite had the same sensors as in the original NITR BALLOONSAT (mentioned above). The upgraded hardware contained extra components like single board computer (UDOO board) and a GoPro Hero3 HD camera. In addition to managing the team, my primary work was to add support for remote image telemetry over the XTend 900 MHz RF module. As XTend was the only channel for remote command and for telemetry of sensor data including image transfer which was a time, the coordination between software components for image transfer was mission critical. My major contributions to the project included –
  - **Developing the intercommunication software** for interaction between the onboard Arduino in C++ and the UDOO computer board in Python.
  - **Interfacing the GoPro** Hero3 HD camera for command to capture image and image transfer over Wi-Fi to the onboard UDOO computer using REST APIs via Python.
  - **Transfer of image** from onboard UDOO to Arduino and then finally to the base station over the XTend RF module. On the onboard computer of the balloon satellite, the tasks involved serialization of the image, segmentation of serialized data into chunks, checksum generation for chunks and a simple acknowledgement and retransmission on NACK algorithm. On the base station the tasks included acknowledgement of the chunk received (ACK), error checking of received chunk using checksum, negative acknowledgement if failed error checking (maximum retires 2, but configurable), assembling the chunks after checksum validation and de-serializing the assembled packets back into a single image. Longitudinal Redundancy Check was tried as retransmissions were slow but were not included in the final algorithm during launch of the satellite.
  - **Base station software** for telemetry data, remote image capture command, image reception and a GUI for showing the received real-time sensor data and image using Python, Node.js and HTML.

  (Prof. Samit Ari and Prof. Ajit Kumar Sahoo – Dept. of Electronics and Communication Engineering, NIT Rourkela).

- **Fabrication of Optical Waveguides using Porous Silicon** (Summer 2015)
  Studied the optical properties of Porous Silicon and its fabrication using electrochemical etching of a crystalline silicon wafer in a hydrofluoric acid based electrolyte. Studied the effect of oxidization of porous silicon on its optical properties. Also studied the working of Distributed Bragg Reflectors and Fabry-Perot interferometer.
  (Paresh G. Kale, Dept. of Electrical Engg, NIT Rourkela)

INDUSTRY RELATED PROJECTS

- **Founding Member and Lead Embedded and Network Developer at PhoenixRobotix** (https://phoenixrobotix.com) (2015-2016)
  - **AURASSURE**
    One of the first team member of the startup Pheonix Robotix (spin off from the Balloon Satellite Lab at NIT Rourkela and the Air Quality Sensor Network team) where I worked as the lead embedded developer after class hours. I managed a team of 3 developers to develop the software stack for an Air Quality Monitoring Kit called AURASURRE (https://aurassure.com). I also led the networking of the devices with the State Pollution Control Boards (SPCB, Govt. of Odisha, India) pollution monitoring servers during which I visited and interacted with the SPCB technical staff to develop an API for the same. My work also included writing driver codes on Arduino for various air quality sensors including sensors from the well-known company Alphasense.

  - **Online Pollution Monitoring of Soft Iron Manufacturing Plants (later called product "TRADE")**
    I was responsible for developing embedded code on Arduino platform for interfacing a hardware device we developed at PhoenixRobotix which collected pollution data like SO_2 and particulate matter from the Electrostatic Precipitator and uploaded it to the Orissa State Pollution Control Boards Server over GPRS for

continuous monitoring of the pollution. All transmissions were encrypted using AES encryption and a custom application packet was used to be sent over TCP. HTTP was not used deliberately to decrease data usage due to header overheads. The device used industry standard 4ma-20ma current loop for collection of data from the sensors. Finally a generic device named TRADE was developed which could be easily deployed in any similar factory and start transmitting data without much manual configuration.
https://phoenixrobotix.com/trade-gprs

INTERNAL NOTE:
We filed for 3 patents and currently have one design patent approved relating to Aurassure product (mentioned above). I had significant contribution to the embedded and network design of the product. Aurrasure's latest model still contains critical sections including driver codes for Alphasense sensor, GPRS modem connectivity and back-off state machine implementation which I had contributed during my time at Pheonixrobotix.

- **Vehicle Monitoring in Open Cast Mines under Unreliable Cellular Network using ZigBee (M.Tech Project)**
(March 15 – May 16)
Funded by Jindal Steel and Power Limited, the project aimed to tackle the problem of near real-time vehicle tracking in an open cast mine which suffers from a poor GSM network. I developed both the hardware and software for the system to solve this problem using a ZigBee network that collects the position and speed data from vehicles when they are not under GSM coverage and then relays it to a ZigBee node which has access to GSM network and hence uploads the acquired data to the Vehicle Monitoring Server over GPRS. The codes were developed using Python for a Raspberry Pi computer which acts as the gateway node, in C++ for the vehicle tracking equipment (mounted on each dumper/vehicle to be tracked) and again Python, HTML and JavaScript for the Vehicle Monitoring Server. The system was deployed at Jindal Iron Mines at Tensa, Sundergarh Odisha India and has been working since March 2016. The project details can be found in my M.Tech thesis which can be accessed at http://nitrjindal.in/static/Thesis.pdf
Project Website (Authentication Required – Guest credentials for demo available on request) http://nitrjindal.in
(Prof. Debi Prasad Acharya, NIT Rourkela)

  INTERNAL NOTE:
  We had no intentions of filing a patent for this product and published this work in a conference, although many members of the project evaluation committee were of strong opinion that the final product was definitely patentable.

PERSONAL HOBBY PROJECTS

- **Grid Solver Line following Robot using Flood-Fill Algorithm.**
- **Remote detonator** using cellphone and DTMF (November 2012).
- **Digital Speedometer** and Odometer for Bicycle (December 2013).
- **Spy-Bot** controlled over Skype/Facebook/3G audio-video chat. (June 2013).
- 8 x (7 SEGMENT) Multiplexed display array exploiting Persistence of Vision.
- Project on Home Security and Automation based on RFID and DTMF (GUI and 3 tier security) (Summer-2013).
- **Music Synchronized Light ART (Light Sequencer) Design for official dance club of NIT Rourkela** (SYNERGY). (February 2014).
  Developed both hardware and code on AVR ATMEGA32 microcontrollers to be attached to each dancer to synchronize the LED suit they wore to the music and the choreography and produce light effects in the dark. This won the group a 1st Prize in the group dance competition at NIT Rourkela and got a lots of appreciation from many dance groups all over Odisha.
- **NEARTHY.COM** (Summer 2014)
  Founded and developed an Online platform for ordering food and stationary by the students of the Institute (NIT Rourkela) from city stores. We ran the site successfully over two months before shutting down due to lack of personal time.

- Developed **Complain Management System** for residential students of NITR to submit Electrical and Civil Complaints using PHP based web frameworks (Winter 2014).
- Developed **theme based room lighting** which detects most prominent color in a laptop screen and changes room color accordingly over bluetooth. The lightings are accomplished using NeoPixel LEDs.
- I2C, SPI and WS2812 (Neopixel) driver for ATMEGA, PIC and 8051 Controllers by bit-banging GPIOs. (September 2016)
- **UART Serial bootloader** for ATMEGA series of microcontrollers.(October 2016)
  Involved understanding of the flash partitions and writable regions of the Atmel ATMEGA microcontrollers and then developing a UART bootloader in C.
- **FAT16 Driver –**
  Involved understanding the FAT16 file system and implementing a driver in C for Listing, Reading and Writing into the files. (December 2016)
- **Using 8051 in Princeton Mode, Execution from RAM; Serial and SD Card bootloader** (January 2017)-
  This project first involved understanding and interfacing an external EEPROM as code memory for the 8051. Next was tricking the 8051 to think it is reading from code space by manipulating the control bus lines of the controller. The address bus and data buses are shared for the code and data space but the control lines are separate which distinguishes the code and data space. The second task was building an UART serial bootloader to load programs into the SRAM from a host computer and then commanding the 8051 to execute the program from SRAM. The third task was to combine the FAT16 Driver from the previous project (above) to access an SD Card using the bit-banging SPI Driver and hence implement a SD Card bootloader. Using the SD Card bootloader and an LCD controlled over I2C, programs can be selected from the SD card, loaded into SRAM and then get executed from there.

RELEVANT TECHNICAL SKILLS

Programming Skills

C, C++, Embedded C/C++, Embedded Assembly
Python, Ruby, Unix-Shell, PHP, Java, Go,
Data Analytics: sklearn, scipy, jupyterHUB
WEB DEVELOPMENT: HTML, PHP, SQL, CSS, JavaScript, AJAX
MVC Frameworks: Code Igniter, web.py 2.0,Flask,CherryPy,webpy
Frontend Frameworks: Bootstrap, Knockout.js, jQuery,vue.js

Familiar Software Environments:

Linux, Robot Operating System (ROS), OpenCV, MATLAB, JupyterHUB
Proteus, Microchip MP-LabX, Atmel AVR Studio
PSpice, EAGLE PCB Layout Design

Familiar Embedded boards:

- Single Board Computers - Raspberry Pi, Beagle Bone, UDOO, Odroid, Orange Pi
- Contiki-OS on Wismote and Zolertia Remote
- ESP8266
- Arduino
- Texa's Instruments TIVA C series Launchpad
- ATMEL Atmega-8/32/640/128, AT tiny-13/85/2313
- Microchip PIC-10/12/16

Familiar IOT Protocols and sensor networks

MQTT, COAP
ZigBee, 6LoWPAN
Modbus

ONLINE COURSES COMPLETED

- Electricity and Magnetism, By Prof. Walter Lewin, MIT (edX) – 94.6%
  Certificate -
  https://s3.amazonaws.com/verify.edx.org/downloads/da8c255d7ed646ddacd97263b6497083/Certificate.pdf

- Machine Learning by Stanford University (Prof. Andrew Ng, Coursera) – 98.8%
  Certificate -
  https://www.coursera.org/account/accomplishments/records/EGAZ6CCEPV74
- Introduction to Computer Science CS50, by Prof. David J Malan, Harvard (edX)
- Multivariable Calculus, by Prof. Denis Aurox, (MIT OCW)
- Signals and Systems, by Prof. Dennis Freeman (MIT OCW 6.003)
- CS 75 – Building Dynamic Websites by David J Malan (Harvard Extension School)

INTERESTS

- Machine Learning, Data Analytics, Internet of things, Communication protocols, Digital Signal Processing, Wireless Sensor Networks
- Embedded Systems, Robotics and Automation, Web-Development
- Electronics in Visual Arts (Light Arts) and Wearable electronics
- Spacecraft propulsion technologies

EXTRACURRICULAR/ACTIVITIES/HOBBIES

- IISc Open Day 2017 - Embedded systems workshop using BBC Micro:bit and a Gesture controlled car (3rd March 2017)
- 1st Position at NITRUTSAV – 2K14 – Annual Spring Festival, NIT Rourkela for group dance competition in which I implemented my LED ART Project.
- Bagged 1st Prize in Circuit-O-Electrica –A flagship event of Electrical Dept. INNOVISION-2013, Annual Technical Festival, NIT Rourkela
- Taught and contributed in Conducting Robotics Workshops in schools
  --- DPS Rourkela and DAV Public School, Chandrasekharpur Bhubaneswar – Summer 2013
  --- DAV Public School Chandrasekharpur, Bhubaneswar – Summer 2015 (4th and 5th May)
- Active member of CYBORG (Robotics Club NITR) and UDAAN (Aero-modeling and Automation Club NITR)
- Audio Recording and Processing
- Singing, Basketball, Football, Cycling, Table-Tennis and Badminton.

PERSONAL INFORMATION

Name: Sampad Bhusan Mohanty
Date of Birth: 26th March 1993
Sex: Male
Marital Status: Single
Home Town: Bhadrak, Odisha, India
Nationality: Indian
Linguistic Proficiency: English, Hindi, Oriya.

DECLARATION_____

I hereby declare that the information furnished above is true to the best of my knowledge and belief.
Place: Bangalore
Date: 3rd September 2018 (SAMPAD BHUSAN MOHANTY)

---------- **APPENDIX FOLLOWS ON NEXT PAGE** ----------

APPENDIX

A) From Master's Thesis (2016) - Vehicle Monitoring in Open Cast Mines under Unreliable Cellular Network using ZigBee

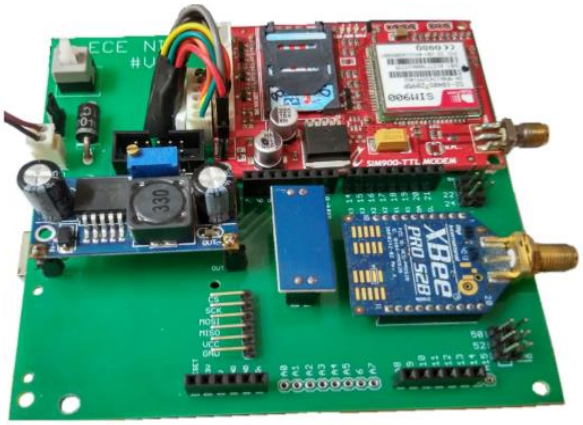


Figure 3.10: VTE Circuit Board

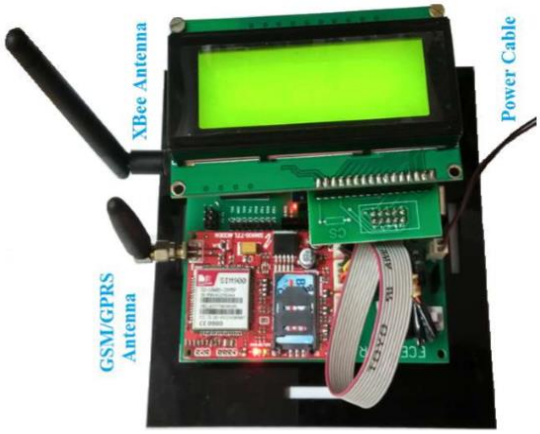


Figure 3.11: VTE Assembly

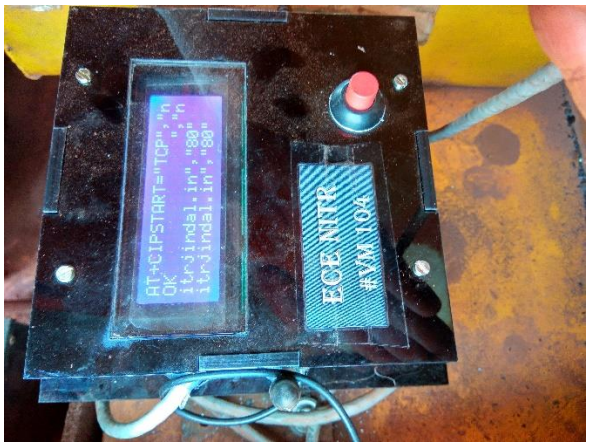


Figure 5.2: CGE installed on a Light Post

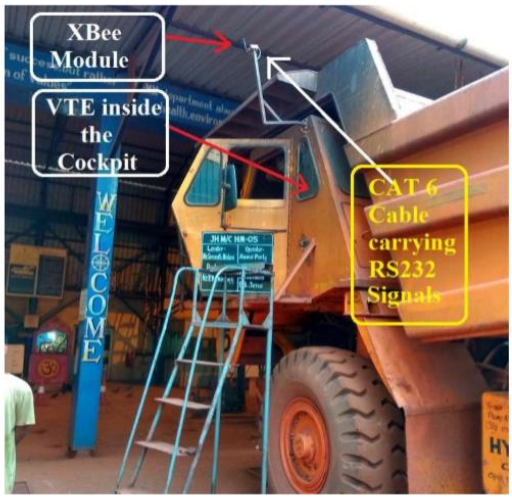


Figure 5.3: VTE installed on a Vehicle

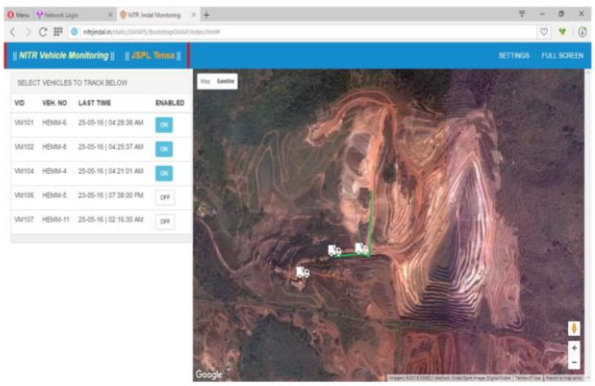


Figure 5.4: Live Monitoring

B) NITR BALLOON-SAT-2

Figure 1: Image transfer via XTend-900 from BalloonSAT2 with data corruption, (Without error checking and BEC)

Figure 2: Live Image transfer Capability over XTend-900 Demo to professors and Director (Image captured on GOPro mounted on BalloonSAT2 – Final algorithm including Error-Detection and retransmissions; LRC based FEC was implemented but not included in the final algorithm)

C) Music Synchronized Light ART Project

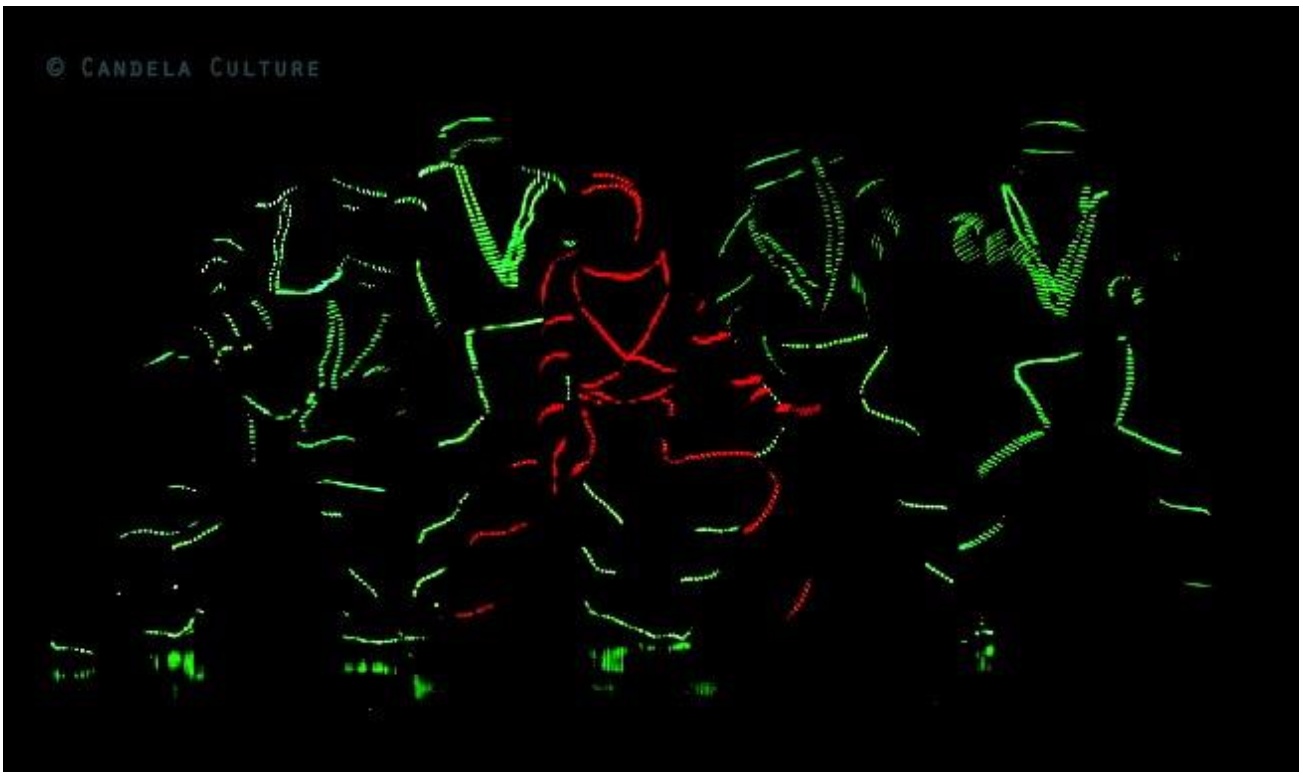
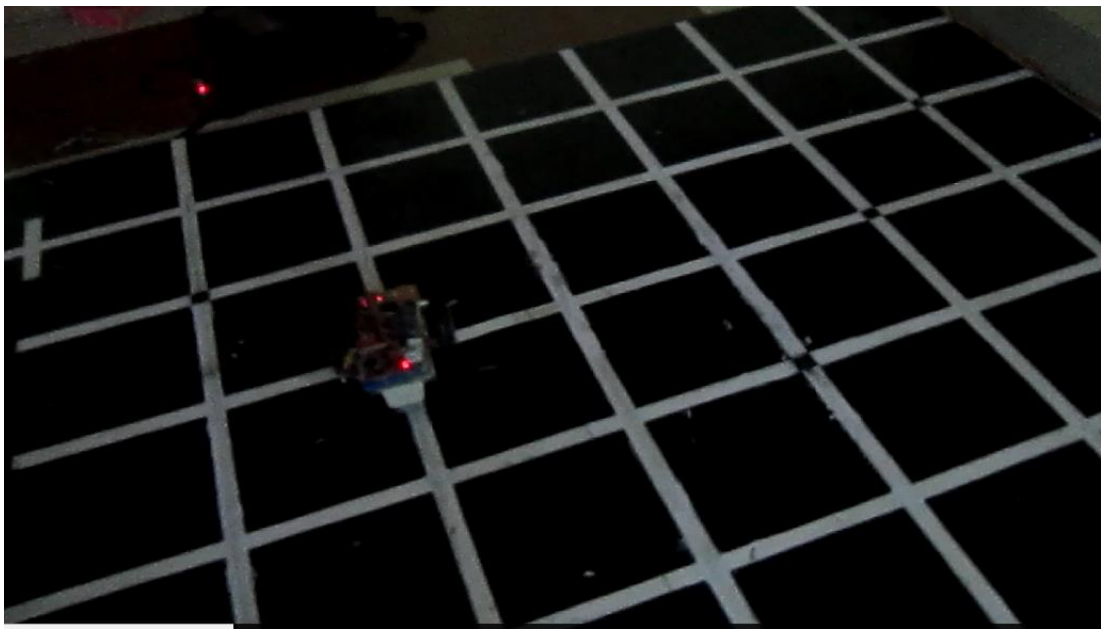


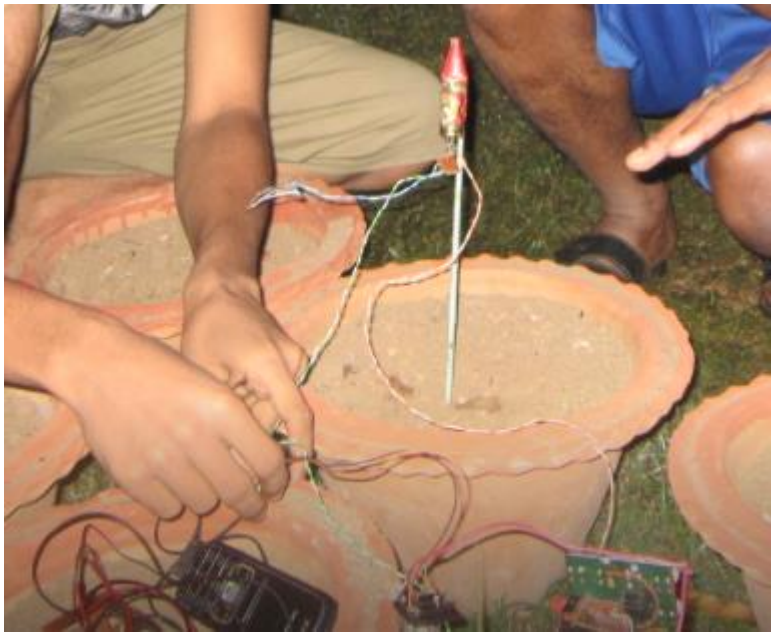
Figure 3: A picture during the performance of the light Art dance sequence. Each of the dancer wears a microcontroller which is synced to the music to trigger the right sequence during the music playback.

D) Grid Solver Line following robot



E) Multiplexed 7 Segment Display using Persistence of Vision

F) Remote detonator via DTMF



G) AURASSURE and TRADE by Pheonix Robotix

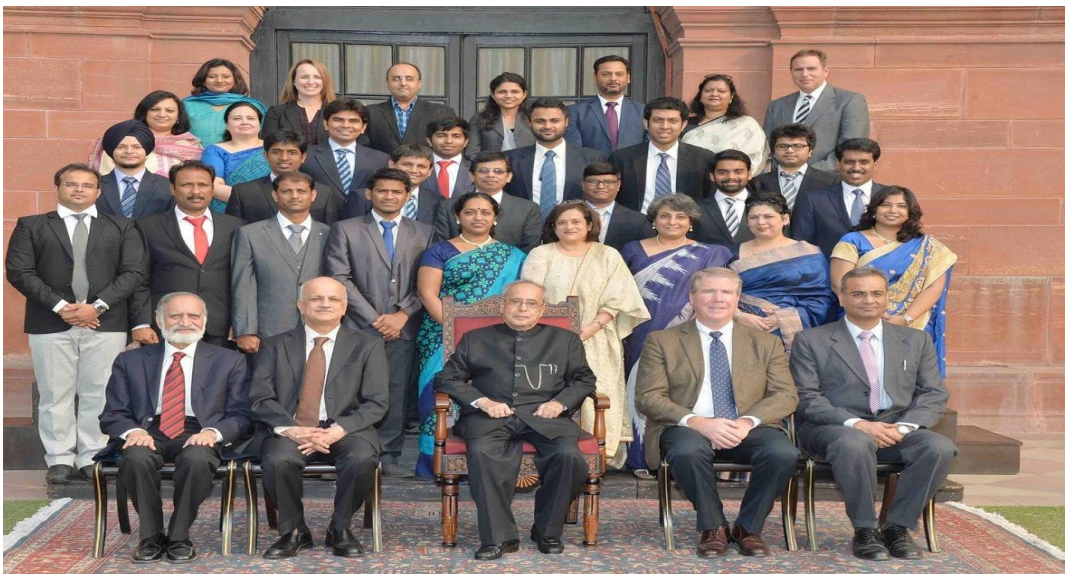


Figure 4: Pheonix Robotix along with top 10 teams of IFDIC challenge meet President of India, Honorable Shri Pranab Mukherjee (2015)