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PROSPECTUS

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About Us

Four students from different branches during the spring of 2013 joined hands to learn about microcontrollers and the different technologies used in making of autonomous robots. Our primary purpose then was to design autonomous robots to participate in different competition held in college fests across India. It took us immense dedication and hard work especially since there was no external or professional aid involved which could better our learning process. After 2-3 months of sleepless surfing of the internet, we learnt more or less sufficient about microcontrollers and automation to design our own autonomous line follower. Our project was a successful one but there were many discrepancies in the line follower that we designed unlike the professional ones. We took no time to rejoice in glory but instead we focused quickly on other major autonomous robots competition that were being held. In no time, we successfully designed our obstacle avoider, edge avoider robot, phototrophic and photophobic robots. Our robots won competitions across India including the IURL (Indo-Us Robo League).

After that, we thought of redesigning our robots and modifying it so it can help society in different ways. We modified our existing line follower to make a solar-powered line follower which could water plants around it. We speculated that this line follower could improve the campus of our university by maintaining the environment. Unfortunately, even this robot lacked the professional accuracy and required high maintenance which rendered it useless.

After the line follower project was scraped, we planned to participate in the NSSC (National Students Space Challenge) held at IIT Kharagpur. Inspired by the problem statement, we worked to design a 5-DOF mechanical arm controlled by a remote operator which could be used by a ground station to pick and place objects in a different planet. Unfortunately, the requirements for this competition were minimal and our arm project became seemingly complex for the competition and thus we crossed all deadlines for designing the robot. The 7-DOF arm project was just halfway complete on 9th December, 2013 when there was a mechanical failure in the arm and we did not have enough funds to procure the materials needed for making amends. Since our project was incomplete, we couldn’t participate in any completion but we presented our research at BARC (Bhabha Atomic Research Centre), Mumbai. Dr. Prabir Pal and Dr. Sanjeev Sharma from BARC appreciated our project and spoke about their research on the 7-DOF Arm. I expressed my desire to collaborate my project with theirs to design a better 7-DOF. They agreed to collaborate with us in the 7-DOF arm for two months (from May-July) to design an intelligent 7-DOF Robotic Arm capable of autonomous control on condition that the final Robotic Arm will be used at BARC to transfer nuclear waste from the reactors to the treatment plant and all research must remain confidential under DAE (Department of Atomic Energy) Act Terms. The NARM team expanded when different students from 1st year contacted us in order to learn about mechatronics and different application. Our newly expanded NARM team constituting of 15 members participated in all the robotics events of ojass-14 where we won the most Innovative robot award in RoboSoccer and Kurukshetra.

Our Achievements

Our Mission

-“Design the Future”

With this motto in mind, NARM strives to design technologies which help in the betterment of life. The Research division designs many technologies which are ground breaking cornerstones in research in Mechatronics. In short, we help mankind climb the evolutionary ladder faster.

The NARM Venture operates on several levels where each level has a particular mission. The details on how each department inside the NARM Venture operates is given within the section titled the ‘Structure of the Team’.

Structure of the NARM Venture

The NARM Team functions with its well-defined structure and a proper hierarchy in everyone’s position in the team. The Core Team of NARM is the head of entire NARM and each subsequent department has a head controlling all divisions and teams under him while each team has a captain controlling his team. The main structure of the team in its hierarchical order is given below.

# The NARM Core Team

The Core team of NARM constitutes of 5 members at maximum including the Team Captain and is responsible for controlling all the departments of NARM directly under it. The NARM Venture and the NARM Team both converge in the Core team to function efficiently. The decision of the core team, headed by the Head of NARM Venture, is final and binding in all aspects of NARM.

The main functions of the core team are given below:

1. Decide on the annual budget
2. Decide on the current research focus for the R&D division
3. Decide on which competitions to participate in the year
4. Plan the entire yearly schedule for different aspects of NARM

The 5 members of the Core Team are:

1. Head of NARM Venture
2. Captain of NARM Team
3. Head of Research & Innovation Division
4. Head of Promotional Division
5. Head of Advisory Team

# Research and Innovation Division

The Research and Innovation division is the most important aspect of NARM and it is responsible for all research that takes place in the field of robotics. The Head of Research and Innovation Division decides on a particular research and divides the research among the different divisions of NARM and gives them a duration to complete their research. The different divisions in R&D and their functions are:

1. Mechanical:   
   Students interested in Mechanical Engineering can join this division. This division is responsible for designing and making the structure of any robot so that the device is strain free and is not prone to mechanical failure. Solar and other alternative energy source based robots are designed in this division. The teams in this department are:
   1. Solar Robotics:   
      In Solar Robotics, students conducts research on different types of solar cells (monocrystalline and polycrystalline), the miller engine circuit and other different interfaces to increase the efficiency of the solar cell. The power requirement and the size factor of a robot are given to the solar robotics team and they are required to design the entire power system of the robot powered by solar cells.
   2. Structure Designing:  
      This team designs the entire structure for the robot. The size factor, torque, strain and other mechanical factors are given to them and they design the entire structure of the robot in precisely two steps. First, they design the entire structure on a CAD Modelling software. Next, the model is analyzed for failure using an analysis software like ANSYS. A proper material is selected for the fabrication that satisfies all the mechanical requirements for the project like density, stress, etc. and the entire structure is made from the material.
2. Electronics  
   The Electronics division designs all the electronic components for the robot including the motherboard design, sensor design and wireless communication circuit and protocol design. The different teams working under the electronics division are:
   1. **Signal Processing:**This team designs all the circuitry for long-range and short-range communication between different devices. It develops algorithms and communication protocols for long range communication and develops algorithms for different serial communication protocols like I2C, SPI, TWI, UART and USART.
   2. **Microcontrollers:**This division designs motherboard for different microcontroller and makes circuitry and add-ons for easy interfacing with microcontroller. It has knowledge of the three major families of Microcontrollers 8051, PIC and AVR. It designs short header files for easy programming of the microcontrollers. It also studies about different types of sensors used in Robotics and designs modules for interfacing sensors and other electronic devices. It also tests new sensors for their rating and specifications and design datasheets based on it.
   3. ARM Cortex:  
      The Broadcom ARM Cortex is a relatively recent technology in the world of electronics and we are studying it to better develop our robots. The Raspberry Pi, Cubie Board are the two main development platforms we use for all projects involving the ARM processor. In this division, the power of the processor is used to develop on-site image processing and localization systems.
3. Computer Science  
   The Computer Science Department designs all the algorithms for making advanced robots. It is responsible for
   1. Algorithm Design:  
      This division designs algorithms for better control of autonomous robots by implementing a variety of control systems along with grid mapping using wavefront algorithm and localization to understand position. It researches on Artificial Intelligence algorithms used in Robotics and Stochastic Systems to make advanced robots.
   2. Device Driver Coding:  
      This division designs device drivers to interface our personal modules and array to existing robotics development systems. This team has an immense expertise in UNIX under FreeBSD and Linux, where it uses its expertise to design device drivers for Raspberry Pi and Wand Board so that the sensor arrays made by the electronics team easily fits in the design
   3. Machine Vision:  
      This is the most important part of completely autonomous Grade I robotics. The machine vision team designs image processing algorithms to detect different features in an image and detects structures for the images. It then samples a number of images from a camera at high frequency and establishes a pattern to detect what is happening in the environment. It then takes decision according to its environment. A patented algorithms has been designed in this field for better understanding of the environment and establishing human identity. PyCamera and Microsoft Kinect Vision are the main hardware components used in this division.

Promotional Division

The promotional division has the task of supervising mainly the advertising aspect of the team. For a team to work effectively, the thing which is of utmost importance is the requisite amount of funds in order to meet the various expenses of the team. Hence the job of promotional team is to post the latest developments within the team on blogging sites, think about various schemes for the improvement of the campus, use web development as well as android app development in order to design pages of our team containing the latest updates of our team and also the task of sponsorship. The promotional division has been further subdivided into various subcategories for productive working.

1. Educational team:   
   The job of the educational team is to post on the blogs the latest research or achievement made by our team in the field of either robotics or mechatronics. Their work is also to organize workshops within the campus in order to make people aware about the main work, goal, dreams and aspirations of the team. They also organize a training for newly recruited students to better understand robotics. Another motive behind organizing workshops is to motivate interested students to join the team and contribute their bit. They also have the work of recording video lectures on various topics concerned with the desired field of interest. Finally, they post these lecture in our online youtube channel.
2. Campus improvement:   
   There goes a very apt saying: ‘charity begins at home’. Similarly, our team aims to incorporate innovation and mechanization and bring about changes within the campus. It inculcates innovation and creative thinking among the students of this institute as well as serves our promotional purpose. For eg. It aims to design and make such a line follower robot which can water plants.
3. Creative Team:   
   They have the task of designing webpages by using web development and android app development and giving information about the progress of the various tasks within the team along with our achievements and main objective in order to attract the attention mainly of the sponsors. They maintain our website and design apps for quick collaboration of projects among our members. This is also necessary so that anyone can get information about us through these pages or blogs and can give us his/her views or share any new concerned information with us.
4. Sponsorship team:   
   The prime objective of this team is to notify and convince the sponsors about the aim and strategies of the team and collect funds from the same in order to meet the monetary requirements of the team. The entire budget and sponsorship details is given later in this prospectus.

The NARM Robo-Con Team

The NARM Robo Con Team participates in the Robocon every year. Selected people from every department in the research division is selected a year in advance and they work all around the year according to the problem statement of that year’s Robocon. The problem statement which involves designing a robot that can perform a series of tasks which when completed award points to the concerned team. The total points are counted to declare the final winner. The total prize money is more than 30 lakhs and the event has more than 30,000 viewers alone in india.

The Advisory Team

The Advisory Team consists of the faculty advisor of the Robocon Team, the Research and Development Advisor and the Financial Advisor. The Research and Development Advisor helps us with all the proceedings required to efficiently conduct research and development in our college. The Financial Advisor advises on our sponsorship details and manages our list of sponsors.

Our Yearly Plan

# The Trainning Phase (September – December)

Robotics is a very advanced discipline and research in robotics is not possible without proper training. After recruiting new members in our team, we immediately start the training phase.   
The training phase occurs for the respective departments of Research and Development and are conducted by students from 2nd year, who are in the Educational Team. The training is divided into two or three modules and after each module there is a minor project and by the end of the training all students would have successfully worked and completed a major project. The syllabus for the training of three departments are given below:

# Research and Innovation Phase (November – March)

The Research and Innovation Phase is the most important aspect