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IEEE REPORT FOR SAMANVAY MAGAZINE

The Institute of Electrical and Electronic Engineers- IEEE, is the world's largest association dedicated to advancing technological innovation and excellence for the benefit of humanity. The strategic plan of IEEE is driven by an envisioned future that realises the full potential of the role IEEE plays in advancing technologies. It is designed to serve professionals involved in all aspects of electrical, electronics and computing fields and related areas of science and technology that underlie modern civilisation.

IEEE is the oldest student body of SIES GST. It is an active body in organising all extra-curricular activities in the college. This academic year, IEEE SIES GST saw a growth like never before within participation for most of its events having increased by leaps and bounds. With Cognition going National this year, IEEE Student Chapter and SIES GST experienced renewed vigour and zeal which got reflected in the efforts put in by the core team with all its volunteers. Cognition '14 became a grand success with IEEE's events conducted on the 16th and 17th of September,2014 receiving enthusiastic participants from the whole state. This time, IEEE SIES GST's technical extravaganza offered IQ-an interactive quiz event, SQUABBLE- an event wherein participants mooted over myriad political, global, technical issues of the world, HACK IN THE BOX- an ethical hacking event for both, amateurs as well as experts in the domain. Apart from this grandeur event, the IEEE Student Chapter also organised various workshops such as Home Automation, Line Follower Robot, Level One Robots, Arduino Workshop, etc. which were largely appreciated. SIES GST's annual fest, Tatva Moksh Lakshya proved to be another platform for the IEEE students to showcase their competency by displaying many Arduino based projects. The Women in Engineering-WIE section of IEEE SIES GST also conducted informative seminars for an ebullient female audience. IEEE SIES GST is also conducting an Industrial visit to get young engineers acquainted with the happenings in PCB making company, Copper Track Industries, Nashik.

On the whole, 2014-2015 was a year of success and achievement in all its endeavours. Under the promising guidance of our Branch Counsellor, Mr. Pushkar Sathe Sir and the leadership of our Chairperson, Mr. Arnab Kundu and the Student Chapter Head, Mr. Sameer Dhuri, the Secretary Ms. Kavya Kumar and Co-Secretary Ms. Jagruti Shenoy along with the entire IEEE team believe in continuing our perseverance to accomplish greater challenges in the forthcoming years.

ARTIFICIAL SOLAR OXYGEN TREE

Preethi Ganesan, Prerna Tripathi, Sneha Thakur

- *Preethi Ganesan is currently pursuing graduation program in electronics and telecommunication engineering in SIES Graduate School of Technology, India, PH-+919167908581. E-mail: ganesan.preethi22@gmail.co*
- *Prerna Tripathi is currently pursuing graduation program in electronics and telecommunication engineering in SIES Graduate School of Technology, India, PH-+919967014136. E-mail: prerna_3005@yahoo.com*
- *Sneha Thakur is currently pursuing graduation program in electronics and telecommunication engineering in SIES Graduate School of Technology, India, PH-+918879227388. E-mail: snehaextc@gmail.com*

1 ABSTRACT

This project is designed to demonstrate the use of solar energy to in order to conserve the conventional energy resources. The artificial solar oxygen tree is controlled by PIC 16 which would be programmed to use the solar energy efficiently for street lighting, power the electrolysis process and display advertisements. Artificial solar oxygen tree converts light rays from the sun into electricity using PV cells connected as leaf on tree and are generally made up of crystalline silicon. This energy is stored in a battery and used for electrolysis process of waste water into oxygen & hydrogen. Oxygen will be released to air. LED lights connected on tree leaf will radiate light in night time acting as a street light. LCD display is also used as a space for advertisement. The LDR sensors will sense the light and hence the street lights will be automatically turned on and off.

2 INTRODUCTION

In the modern world of urban population, we can't grow enough trees naturally to convert carbon dioxide into life sustaining air. Oxygen tree is a revolutionary urban lighting concept that represents a perfect symbiosis between pioneering design and cutting-edge eco-compatible technology. Solar Tree opens up new prospects for urban lighting in that it satisfies today's most pressing environmental, social, cultural and aesthetic demands. The ability to combine innovative design along with environmental concern is the sole idea of this project. Man has forgotten that is a PART of Mother Nature and NOT APART from it. The increase in cutting of trees has affected not only the balance of gases in air but also soil erosion has led to the loosening of roots which leads to felling of trees causing accidents.

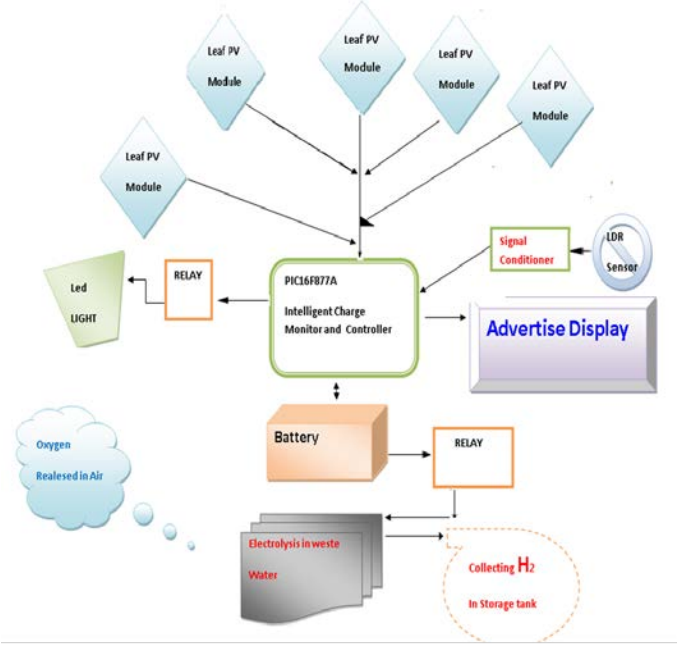
As it is we don't see much of trees in the urban areas due to newer commercial and residential complexes coming up we could probably think of paving the way for artificial solar oxygen tree which would also provide lighting to the complexes and streets. The daily average solar energy incident over India varies from 4 to 7 kWh/m^2 with about 1,500–2,000 sunshine hours per year (depending upon location), which is far more than current total energy consumption. For example, assuming the efficiency of PV modules were as low as 10%, this would still be a thousand times greater than the domestic electricity demand projected for 2015.However, India is ranked number one in terms of solar energy production per watt installed, with an insolation of 1,700 to 1,900 kilowatt hours per kilowatt peak (kWh/KWp)

All the waste water from the buildings is gushed out into the sea thereby ruining the sea life and collection of unnecessary waste in the sea. This would prove harmful to all of us. The waste water from the complexes when filtered and electrolyzed would not only help in generating oxygen and hydrogen but also reduce the sea pollution to a great extent. The reduction in oxygen levels is being felt all over the world. Oxygen deficiency leads to mental and physical disorders not only in humans but also in sea creatures. Planting trees in urban areas is almost impossible with so many skyscrapers and industries already being there. The artificial solar oxygen tree would compensate for this loss to some extent at least. After all "Something is better than nothing".

3 OBJECTIVES

1. To promote the use of solar energy.
2. Reduce pollution caused by CFLs by using LEDs
3. Efficient use of waste water.

4 BLOCK DIAGRAM



There are 6 PV cells used to collect solar energy.PIC16F877A is used for controlling the entire circuit. The collected solar energy will be used to power the electrolysis process in which waste water is used, display advertisements or display weather conditions, and provide street lighting. LDR is used to sense the light intensity. As soon as light intensity decreases the LED's will be turned on. Thermistor is used to control the hydrolysis process, as the temperature increases during daytime there is a chance of hydrogen bursting. Thermistor will signal the PIC to cutoff the supply to the electrolysis tank. RELAYS are used for this purpose.

5 COMPARISON WITH SIMILAR PROJECTS

France, in collaboration with Shift Boston are proposing to use this environmental friendly technology to help curb CO2 gases in the city. By using biomimicry, or drawing inspiration from nature, Influx Studio developed their tree-like structure to be powered by both solar and kinetic energy. Their artificial tree mimics what real trees do. It scrubs CO2 from the atmosphere and emits O2 and uses its own power to do so.

The proposal could be define as a CO2-scrubbing living machine. Treepods may well redesign in an urban radical new way our polluted urban environment, interacting with natural trees, and enhancing its carbon absorption capacity. In that way, those artificial trees don't replace the natural ones, but they act like small urban "air cleaning infrastructures".

Advanced technologies are actually already developed that allow the capture of the atmospheric carbon dioxide from ambient air in an efficient, economic and sustainable way. Developed by Dr Klaus Lackner, Director of the Lenfest Center for Sustainable Energy at Columbia University, this revolutionary process is based on the discovery of the 'humidity swing,' a technology that enables the energy-efficient capture of CO2 from air, allowing to close the carbon cycle and creating a valuable product for beneficial use.

6 ACKNOWLEDGMENTS

This work was supported in part by the Department of Electronics and Telecommunications, SIES Graduate School of Technology. Also supported by the head of the EXTC department Dr. Atul Kemkar and project guide Prof. Nisha Singla and Prof. Shivkumar

7 CONCLUSION

This project focuses on making extensive use of solar energy and thus reducing the usage of conventional energy sources. This is a one-time investment and is cost effective. It can be implemented in buildings, hospitals, malls etc.

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Techopedia 2014

Unlike previous years when Techopedia was an individual event held every September, IEEE SIESGST's very own festival Techopedia 2014 was a part of Cognition, which went national this year. Having said that, Techopedia 2014 left no stones unturned to leave its mark in this Cognition with its innovative events; namely IQ, Squabble and Hack-in-the-box.

IQ

This quiz event was held on 17th September 2014 and hosted by Pramit Kumar and Vivek Venkatram for IEEE- SIESGST. About 25 teams participated in the level 1 of this quiz which was an online round that opened on 13th September 2014. Level 1 consisted of 3 rounds while level 2 comprised of 5 rounds; namely Achilles heels, CGPA rules, U miss I hit, Audio-visual rounds. Level 2 was held in SIESCOMS Auditorium on 17th September 2014 that begin with a pen and paper round followed by other interesting rounds that gave 6 finalist teams; Team Android, Team Windows, Team Chrome, Team Macintosh, Team Unix and Team Linux. The quiz had questions that ranged from the clichéd technology trivia to the popular TV series Breaking Bad. The best three teams were awarded prize money of Rs. 20,000, Rs. 15,000 and Rs. 5,000 respectively where Team Android from Mithibai College stood victorious at first position.

Squabble

This event, nicknamed the 'Battle of words', was held on 16th and 17th September 2014. It comprised of 3 rounds in all. About 40 teams participated and showcased their debating skills. The contestants were judged by Mrs. Seema Khan, TPO and faculty of Communication skills at SIESGST, along with her co-judge Ms. Anita Nair. At the end of this competition, the team comprising of Raj Khot emerged as winner while Kashish and Malcolm bagged the runner-up position.

Hack-in-the-box

With hack-in-the-box, IEEE-SIESGST set a benchmark for all amateur-level hacking events, opening an arena for all those who have a penchant for ethically hacking into the world of web. This first-time-in-GST event saw tremendous footfall with hacking enthusiasts pouring in from all places. On the whole, the event seemed to be a great success.

Autonomous Garbage Sorting and Collecting Bot on Firebird V

Shashank Krishnan[1], Poojitha Prasad[2], Udita Retharekar[3], Samarth Shetty[4]
Electronics and Telecommunication
SIES Graduate School of Technology, Nerul
Navi Mumbai, India.
[1]: 1shashankpv@gmail.com [2]: pooji2201@gmail.com [3]: udita.retharekar2@gmail.com [4]: sssamarth07@gmail.com

***Abstract*— Today the biggest problem in the field of waste management is to sort the waste into wet and dry. The project is primarily based on a robot that will identify the waste on the floor, in the corridors, collect it and sort it into dry and wet before putting it into respective dustbins. The robot will scan the area where it is deployed to find any waste materials using proximity sensors. On reaching the waste materials it will identify the waste material using the sharp sensors. In case the robot is confused it will click a picture of the object using a camera and send it to a remote station using GSM or ZigBee module. On confirmation the robot will proceed to the sorting algorithm. The sorting algorithm is based on image processing using MATLAB. With the help of the MATLAB codes the robot will sort the garbage into wet and dry and place it in the respective garbage bins.**

Keywords*— *Autonomous, bot, collecting, firebird v, garbage, segregating, sorting

I. Introduction

This project is based on garbage and it might be interesting to know that we chose to make our project on garbage because we hate garbage. We firmly believe that the garbage or waste should be reused, recycled and disposed properly. One of the major hindrances in the path is the process of identifying the waste and making it available for recycling or disposal methods. Current global waste generation levels are approximately 1.3 billion tons per year, and are expected to increase to approximately 2.2 billion tons per year by 2025. With this amount of waste being generated there is a constant need for waste management techniques.

The biggest challenge is encountered in sorting the garbage into various categories before moving it for the appropriate process of recycling. In lesser developed countries the method of hand sorting is still practiced. The waste collected in a large area is brought into small workshops where people try very hard to sort the waste materials by shape, size, colour, feel and smell. None of the above techniques result in any amount of help in any significant way also it puts the health of the people working in these workshops at risk. Thus, a robot with artificial intelligence to sort waste can make the process of waste management a lot simpler, easier, economically viable and safe.

II. Objectives

A. To identify any stray object on the ground in the area under consideration.
B. To identify whether the given material is a waste material or not
C. To pick up the object using the metallic arms
D. To sort the materials into dry, wet or metallic with the help of various mechanisms
E. To drop the sorted objects into appropriate garbage bins

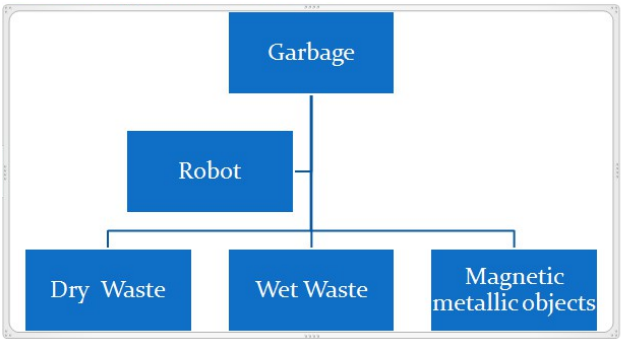
III. Methodology

Step 1:
The robot has to search and scan the whole area where it has been deployed to find any waste materials. For this we will use the proximity sensors and MATLAB. The camera fixed to the robot will continuously scan the whole area under consideration and look for any object.
For identifying the object the robot will compare the current image with the previously stored standard image of a clean area. After identifying the object the robot will move towards the object.

Step 2: On reaching the object the robot has to identify the garbage from other objects. Here the proximity sensors of the robot can be used to identify the waste based on shape and area. The robot will also have a camera which can identify the waste with the help of MATLAB code. The robot will compare the image of the object with images previously stored in the database and identify waste on the basis of similarity. In case of conflict the robot can send the captured images to the nearest workstation through ZigBee or GSM for approval of the user which will help in final identification of waste. The general idea is that instead of instructing a computer what to do, we are going to simply throw data at the problem and tell the computer to figure it out for itself. In case of our robot the robot will make an error in identifying the waste from other objects but over the time with a lot of data the robot will become an expert in identifying the right object.

Step 3:
The robot will be fixed with two metallic arms to pick up and place the waste into a dustbin. The dustbin will be painted in red color or any other color and the robot will be programmed to track the red object and move to it. Thus making it easier for the robot to reach the dustbin after collecting the waste. There will be three dustbins to collect three different types of waste materials viz. dry waste, wet waste, metals. The dry waste bin will have 2 dots on its body, while the wet waste bin will have 3 dots on its body and the metal bin will have 4 dots on its body.
Thus with the help of MATLAB the robot will understand where to drop the type of waste it has.

Step 4:
Sorting the waste is a key to the success of the project. The magnetic objects can be identified very easily due to their magnetic properties. The metallic arms of the robot will have electromagnets fixed into them which will pick up the magnetic objects and thus the robot will understand it is a magnetic object. Now if the electromagnets are not able to pick up the object the metallic arms will open and the object will be picked up.
The metallic arms will feature a moisture sensor. This sensor will identify the wet waste if there is moisture in the material and classify it as wet waste on reaching the dustbins. The waste objects with no moisture content or moisture content below threshold level will be classified as dry waste.



IV. Comparision with similar projects

Projects similar to our project were studied and the comparison of our project with those projects was made. We took two projects for comparison in particular viz. fruit picking bot and a garbage sorting bot.

The fruit picking bot basically identifies fruits in a farm based on the shape and size of the object and picks it up and drops it into a basket Another garbage sorting robot is a high speed, high efficiency robotic arm which is currently being developed by a waste management company in Finland. The robot sorts the garbage into biodegradable, non-biodegradable, glass, metal and plastic with the help of image processing at a very high speed. Our robot will work using the principles of image processing but at a lower speed

Acknowledgment *(Heading 5)*

This work was supported in part by the Department of Electronics and Telecommunications, SIES Graduate School of Technology. Also supported by the head of the EXTC department Dr. Atul Kemkar and project guide Prof. Shyamala Mathi.

Conclusion

The project aims to find a remedy to the ever growing and nagging problem of garbage collection and sorting at households and work places. We believe that the project will help bring a substantial change in this field and make a contribution towards Prime Minister Modi's "Swacch Bharat Ahiyaan" in India.

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[8] P.Rohitha1 ,P. Ranjeet Kumar2 Prof.N.Adinarayana3, Prof.T.Venkat Narayana Rao4 ,
"Wireless Networking Through ZigBee Technology" ,1B.Tech IVth Year Student, E.CE 2B.Tech IInd Year Student, C.S.E 3Professor and Head, ECE 1,2,3KKR & KSR Institute of Technology and Sciences 4Professor and Head, HITAM, Hyderabad, A.P
[9] Dr.S.S.Riaz Ahamed." THE ROLE OF ZIGBEE TECHNOLOGY IN FUTURE DATA
6
COMMUNICATION SYSTEM" Professor & Head, Dept of Computer Applications, Mohamed Sathak Engg College,Kilakarai & Principal,Sathak Institute of Technology, Ramanathapuram,TamilNadu, India-623501.

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Arduino Uno Workshop

On the 31st January and 1st of February 2015, the IEEE student chapter of SIES Graduate School Technology organised an interactive workshop in order to inure students regarding concepts of Arduino Uno.

The IEEE members along with the co-ordination of other organizers conducted a two day workshop where a smorgasbord of various sub topics right from the roots of the subject to its implementation in the modern world were encompassed. An enthusiastic response in the form of participation from the students led to the success of this workshop. The legion of the animated learners ranged from the environed all four years of engineering with an active participation of nearly 70 people.

The first day of the workshop commenced with dissertations of the Head of the Department for Electronics and Telecommunications, Dr. Atul Khemkar Sir and the IEEE SIESGST Co-ordinator, Mr. Pushkar Sathe Sir. The organisers, Mr. Akash Kochare from third year Computer Science department and Mr. Sujesh Menon of third year Electronics and Telecommunication conducted the workshop in unison starting with a brief idea of the functionalities of a microcontroller and its uses in the Arduino board.

The first half of the day consisted of theory session followed by the practical application. After installation of the Arduino softwares in laptops, preinstalled simple programs like LED blinking, temperature sensor etc. were implemented by the students under the guidance of the organisers. The components of an Arduino Uno board such as Atmel CPU, an on chip A/D Convertor; bidirectional ports for both analog and digital output a USB connection as well as a connector to directly connect the board to the battery without using a laptop or a desktop were explained thoroughly. Subsequently came the part of interfacing LEDs with the Arduino Uno boards. One of the assignments given on day 1 was to blink 5 LEDs in a fixed pattern which involved a bit of self programming, but in all helped the groups improve their efficiences.

The session was very interactive as the students built a friendly rapport with the speakers and were at ease in clearing their doubts. After a refreshment of around 45 minutes, the practical session actualized. The day came to an end around noon.

The second day was spent in doing some advanced programming. Students were interfacing buzzers and the leds together, making arrays of elements, combining photodiodes and LEDs together to make a light sensing circuit, and much more. An important feature of the Arduino Uno board explained was its use in home automation system. For this, the Arduino Uno board was interfaced with a GSM module a relay. The basic idea of this experiment was to show that we could control the appliances in our house even without being resent in the house by the use of the Arduino Uno. Then after the break in the second day, students started with the assembling of the line following robot using the Arduino Uno board. The required equipment and materials were provided by the student body.

Thus, an enlightening experience for all fields of engineers, the workshop ended around 7. This workshop also proved to be very beneficial because now these students have had first hand

experience in the usage of Arduino Uno boards and its implementation can be vast and capacious in future years. The IEEE SIESGST members will continue their perseverance to come up with more such informative seminars and workshops .

Autonomous Robot for Mapping and Navigation

Arnab Kumar Kundu[1], Salim Masumdar[2], Prakhar Singh[3], Nikita Kothiwale[4]
B.E – Electronics and Telecommunication;
South Indian Education Society Graduate School of Technology, Nerul , Maharashtra , India
1: (arnabkundu247@gmail.com) , 2: (salimmasumdar@gmail.com)
3: (prakhar.singh9294@gmail.com) , 4: (nikitakothiwale@yahoo.com)

***Abstract*— AUROMAN (Autonomous Robot for Mapping & Navigation), can be used for the surveillance and monitoring of the surrounding. It moves from one location to the other, provided by the user. Autonomous system allows the robot to understand the location and constantly give feedback to the user with a map of the locality on the screen. The robot also uses this generated map for navigation.**

***Keywords*— AUROMAN, Robot Operating System (ROS), Rviz, tf, mapping, navigation, Tele-Operation, Laser, ROSAria, SBC, 2D, SLAM.**

I. INTRODUCTION

AUROMAN is a 45cm cube with an Aluminum chassis. The structure has parallel slots to accommodate devices within the robot. The robot is a model of the Pioneer family of robots (Pioneer 2) with a processing unit which is a SBC (Single Board Computer), containing Intel Atom i386 Dual Core processor, 1GB DDR3 RAM and 40GB SATA HDD. The distinguishing part of this robot is that it works on ROS; Robot Operating System. ROS is an open source meta- operating system which is available in numerous versions, for example Hydro, Indigo etc. AUROMAN uses the ROS Hydro Medusa version which is implemented via Ubuntu. It may be implemented using windows and MAC OS as well. ROS as an operating system provides us with hardware abstraction, low-level device control,

AUROMAN (Pioneer Family of Robots)

message passing between processes at decent speeds, package management and distributed system; all of which prove to be ideal for low level initialization of the robot. Autonomous Robot for Mapping and Navigation thus is the implementation of ROS for mapping and navigation.

II. WORKING CONCEPT

Forming the map is the most important part of AUROMAN. Constructing a map requires a device capable of scanning the surrounding and marking the terrain and obstacles present in the vicinity. For this AUROMAN uses Hokuyo UTM-30LX Range Finder. The Ranger Finder is a laser which scans and gives us a 2D (two dimensional) - outline of the

surrounding on Rviz (ROS-visualization), which is an image viewing interface available in ROS. This image is then converted into a format which can be stored as a map. A real time map is generated by allowing the robot to move around in the vicinity. This map is then used to identify locations and navigate the robot though them. To make this operation wireless a router is attached to the robot.

III. INTERFACING THE LASER

The specifications of the Range Finder are; supply voltage of 12v, measuring range of 30m, field of view 270^0 and angular resolution of 0.25^0. In order to start the functioning of the laser we require to install some drivers which facilitate the laser scanning. Commands to be followed are:

sudo apt-get install ros-hydro-urg-node

Then, after the laser nodes have been obtained by the processor. The next step is to run that node;

rosrun urg_node urg_node

This command enables the laser and the laser begins to scan the surrounding.

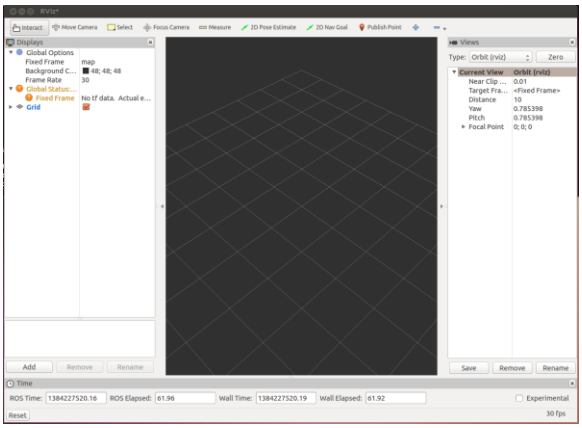
Now to gather the laser data we use the following command;

rostopic echo scan

The laser data in now being fetched; however it is not yet available for the user to view. For the user to see the laser data we need to initialise Rviz.

rosrun rviz rviz

Rviz is the visualization tool for users to see the 2D image of the scanned data. Different formats of viewing the data can be implemented via Rviz by adding different topics available as options within the software.



The Rviz Interface

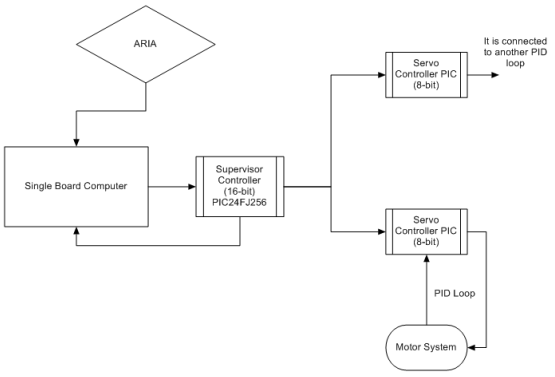
IV. MOTION CONTROL SYSTEM

A real time map requires the robot to move and scan the surrounding. For the motion control system the robot has a pair of servo motors which operates with the help of two pic servo controllers. These two controllers are monitored by a supervisory controller PIC-24FJ256. The feedback loop of the motors is a PID (proportional-integral-derivative) loop which enables the robot to move in a directed path by error reduction. RosAria is the node for motion control in ROS. It enables the motion control commands to be employed over the supervisory controller by the help of the SBC. The command for burning the Aria node into the SBC is;

rosrun rosaria RosAria _port:=/dev/ttyS0

S0 represents the port at which the device receives the code for ***RosAria***, ***rosrun*** allows us to run an executable in an arbitrary package without having to change the directory. For the user to control the motion of the robot via keyboard we may implement the teleoperation node. To call that node we use;

rosrun teleop_auro teleop_auro



Motion Control System

It is also very necessary for the user to keep ***roscore*** active in a background window. The ***roscore*** command is of great importance as it prepares the robot to receive commands in Robot Operating System. Every command in ROS can be executed only after ***roscore*** has been initialized.

V. UNDERSTANDING TF

In a real time map generation system, there is an unavoidable necessity of proper synchronization between two time frames. If the visualization tool Rviz is to define one unit of time with the help of its occupancy grid then ***tf*** is the packet that assures proper synchronization between data of two different time units. ***tf*** is a standardized protocol for publishing transform data to a distributed system. It lets the user keep track of multiple coordinate frames over time. ***tf*** APIs allow making computations in one frame and then transforming them to another at any desired point in time. It builds a tree of transforms between frames. So, every time there is any relative motion between the robot and the obstacle the comparison of the coordinates is performed by ***tf***. Thus, a certain precise location is obtained. Due to the presence of ***tf*** the user need not worry about the starting position of the robot, the orientation is managed according to the convenience. The previous location is also stored so the comparison becomes much easier. By the help of this transform library, i.e., ***tf*** we can enable transforms on multiple instances without any loss of data.

VI. MAPPING

Once the laser has been initialized, it starts to obtain 2D data from the surrounding. Our requirement is to interpret this 2D scan of the surrounding into a map and utilize it for visualizing and choosing paths for AUROMAN to follow. Mapping in AUROMAN takes place with the help of the SLAM algorithm. SLAM stands for simultaneous localization and mapping. It is a technique by which robots can develop a map of any unknown environment and meanwhile also keep a track of their current location. There is no implementation of global positioning system in AUROMAN, therefore SLAM facilitates the real time map generation. The simple idea which is followed is that the obtained unbiased map and the approximately estimated pose are correlated. Hence, the map and the location are interdependent.

In ROS, mapping and enactment of the SLAM algorithm is enabled by the ***slam_gmapping*** node. Till now we have observed the laser scan and know the 2D outline of our surrounding. However by this, a map is not yet saved; gmapping package requires a sequence of commands by which a map is saved;

rosrun auro_tf tf_broadcaster

It broadcasts the data obtained on the 2D occupancy grid map of Rviz. Now we need to run the slam_gmapping node;

rosrun gmapping slam_gmapping

This command enables us to obtain a real time map depending upon the current location of the robot just as what the algorithm suggests.

For saving this map;

rosrun map_server map_saver –f mapname

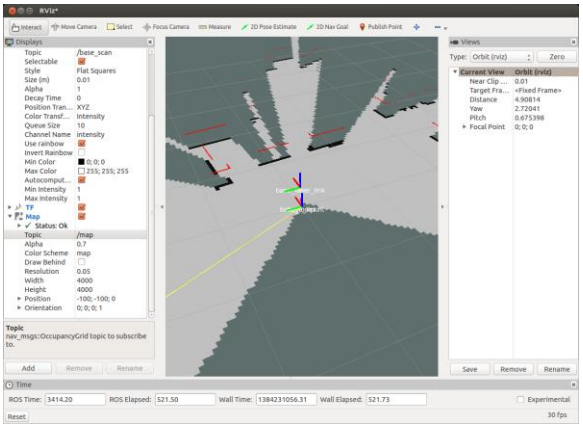
In order to publish the saved map on rviz;

rosrun map_server map_saver –f mapname

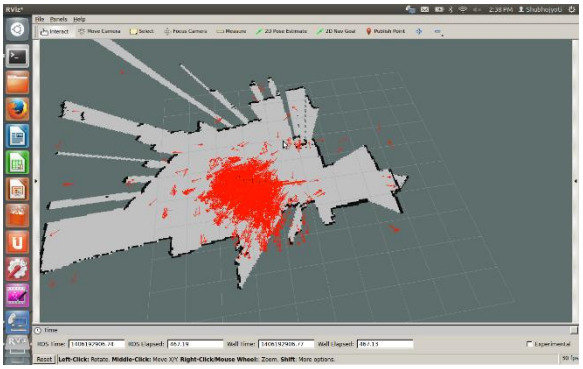
Now we have a map opened on the rviz for further implementation. After this we need to realize the position of the robot on the map. For this we require localization; run the localization node.

rosrun amcl amcl

Amcl implies Adaptive Monte Carlo Localization, Amcl uses a particle filter to track the position of a robot by using a method of KLD Sampling. It publishes the Cartesian co-ordinates, heading direction and covariance of the robot. Amcl thus aids a map to be understood.



Map Display (saved map)



Map Display (localization)

Now we have a streaming map which is compared with the saved map for localization, as the robot moves around. Localization determines the probability of finding the robot in a certain area. Wherever we find the density of localization high the chances of finding the robot in that area is the maximum. As far as the movement of the robot is concerned, it can be controlled by an alternative code which avails the user to change velocity and angular drift at will unlike the teleoperation node mentioned earlier;

rostopic pub -1 /RosAria/cmd_vel geometry_msgs/Twist '{linear: {x: 0.1, y: 0.0, z: 0.0}, angular: {x: 0.0, y: 0.0, z: 0.0}}'

VII. NAVIGATION

Once we have a map ready, the robot needs to identify the map and locate points within it. This is when navigation comes into the picture. To start with navigation we need to construct navigation stacks which takes information from the map generated and allows the user to set a destination or a target location for the robot. Because of this navigation stack the robot is prevented from crashing or getting lost into some random location.

However, there are certain requirements for the navigation stacks to perform at an optimum capacity. For example, it cannot give efficient error correction for sideways motion, it can handle only differential motion and it also requires the system to be either square or circular for best results.

Once the launch files and all the executables have been arranged we need to run the navigation stack. The following two commands are needed to be executed simultaneously in two parallel terminals;

roslaunch my_robot_configuration.launch

And,

roslaunch move_base.launch

After this we have functioning navigation stacks. To send goals or defined targets we need to implement another node exclusively for the purpose. Once the node is created the source code needs to be executed. The best part of initializing these two launch files is that there is no further need to call each of the nodes all over again. After launching these, we are able to start the ***aria***, ***tf*** and ***urg*** nodes automatically. However, one thing to check is that the launch file created during the navigation stack should be similar to the name of the action mentioned in the node to identify the goal. All of this can be achieved by the Rviz visualisation tool itself.

VIII. FUTURE SCOPE

The futuristic aspects of this implementation most certainly will be to create easy synchronization between the SBC and the devices implanted upon the chassis. The robot should preferably be as compact and have an easy accessible circuitry. Furthermore, if multiple sensors are to be considered for implementation then Kinect and panorama cameras are something any user can eye for. With the Kinect obstacle avoidance and image capture will be feasible and the resolution of the obtained image will be much enhanced. In case, there occurs a requirement of a view of much larger span then panorama camera may be used to obtain a 360^0 view.

IX. CONCLUSION

AUROMAN in the practical world has huge implementations, mainly as a surveillance device for the military or the army, sight inspection mobile robot and even as a household robot. But for any practical implementation where stealth is a requirement the robot's size is something that needs to be worked upon. While working with the robot, the issue of mismatching data rates of the laser and the transforms created hindrance and there were unnecessary stoppages in between commands. Also it was observed that the complete packing of the robot physically was affecting the stability of the robot. It is hence advised to work with sensors with similar or very close data rates so that synchronization can be maintained.

Also, it is to be taken care that the hardware is as stable and compact as possible, if not then the robot suffers jerks and smoothness of the motion of the robot is lost. Due to the availability of packages and open source operating system the implementation was very user friendly. Thus, the Robot Operating System was implemented and laser scan data was obtained. This data was converted into a map, which was used to give instructions in the form of navigation targets to the robot. The robot finally moves to the desired locaion.

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INDUSTRIAL VISIT TO COPPER TRACK INDUSTRIES

On the 8th March 2015, the IEEE student chapter of SIES Graduate School Technology organised an industrial visit to Copper Track Industries, Nashik in order to inure students regarding concepts of PCB making.

The Industrial visit was mainly conducted for the second year engineering students of the electronics and telecommunications branch. The two professors who were present on the day were Mr. Pushkar Sir and Mrs. Sonal Ma'am. The industry was located on the outskirts of Nashik city in the Maharashtra Industrial Development Corporation (MIDC) zone. The basic aim of the visit was to enlighten the students about what Printed Circuit Boards are and how do factories manufacture them.

We assembled at college around 7.00 am in the morning. Then, we were to be taken to the industry in 2 buses. It was a 5 hour long journey of approximately 165 Km. We reached the industry around 11.00 am. We were then given files which contained all the details of the company such as the name of the founders, directors, the number of employees associated with the company,etc.

After that we were summoned to a training session hall in order to enlighten us about the procedure for PCB developing. It was a very interactive seminar where even our mundane knowledge about PCB's were corrected.

We were given first-hand knowledge about the basic intricacies involved in the manufacture of PCB boards. This theory knowledge was very important in order to relate to the hands-on experience that we received after the session. After a wonderful one and a half hour of the seminar, we were asked to give our feedback and each of us were also give a certificate which stated that we have been to copper track industries and have studied the process over there.

Then we were divided into four batches and one by one we were sent into the company to see the stepwise procedure of making a PCB. After an informative session, we surely could say that everyone had garnered at least a basic idea about the PCB manufacturing.

Thus, the day ended on a very thought provoking note about the future of every EXTC student and we surely were mighty impressed to know that this Industrial Visit has carved a niche in every student's psych.

GUI CONTROLLED AERIAL DRONE

Kartik Panicker, Vaibhav Murkute, Deepak Padhi, Akash Narkhede
Department of Electronics and Telecommunication, SIES Graduate School of Technology,
Sri Chandrasekarendra Saraswati Vidyapuram, Sector-V, Nerul, Navi Mumbai - 400706, Maharashtra.
Email: kartikpanicker@gmail.com,vaibhavmurkute.67@gmail.com,padhideepak89@gmail.com, narkhede.akash@gmail.com

***Abstract*- The aim of this project is to create a flying machine that is capable of obeying users commands through a dedicated and customized environment that user uses to simulate and control the flying machine. It also empowers the user to guide the machine through difficult terrains and altitudes and perform reconnaissance and ambush operations. Basically a robust framed flying engine that possess high end futuristic adaptations to the existing frame to strengthen the military's tactile stance on enemies. To develop an aerial drone capable of performing advanced flight tactics and wireless control through an interface made in MATLAB GUI. The project shall be known for its user customized control environment and remote data surveillance similar to reconnaissance operations led by the military forces**.

***Keywords*- Quadcopter, sensors, closed loop system, hardware programming, microcontrollers, Graphical User Interface (GUI).**

I. INTRODUCTION

The project concerns about development of an aerial drone capable of being controlled with the help of a Graphical User Interface provided as a side packet installment in MATLAB software as well as using LABVIEW which is a visual programming language that controls the data stream flow. This ensures creation of a dedicated, user customized software for flying the drone by sitting remotely and operating in a standalone PC or laptop. The main body of aerial drone has a microcontroller which is responsible for generating control signals according to the user desired flight position information provided by the GUI. The body also possess wireless control system and a controller unit to manage power supply and generation of three phase current signals for the rotors. A closed loop system has also been employed to ensure robustness and stability of the drone at high altitude and unpredictable and unfordable circumstances which ensures sturdy and certain flight position. Moreover future adaptations also concerns about development of a wireless camera whose live streaming can be witnessed by the user on a remote laptop by the concept of virtual terminal.

II. PAST ROBOTICS DEVELOPMENT ON SIMILAR GROUNDS AND IMPROVEMENT IN DESIGN

US Defense forces have a research and development wing named as DARPA. In the recent years, world has witnessed remarkable achievements in the field of robotics dedicated for defense forces which ensure the tactile strength of the forces also reinforcing the military might. DARPA has been one such institution. Hence it has been our endeavor being engineering graduates to build an aerial drone that is capable of reinforcing the military might of the very country, many folds. So we are developing this drone to make it agile, stealthy good enough for leading an ambush operation on enemy targets, where casualty of the INDIAN ARMY has to be kept minimum and reaching difficult terrains and altitudes to take tactile decisions towards enemy's stances. This is the main aim, to make the opponent feel our presence as formidable. A prebuilt model of similar structure was being made, but it implemented open loop system wherein the user cannot control the flying drone, rather he/she can make it trigger to an oncoming

target. This was a very crucial step where we are planning to give it a closed loop system in MATLAB GUI such that every motion of the drone rests with the user.

III. RESOURCES USED

Hardware components used in this project are as following:

ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328.It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller.

Figure 1. Arduino Microcontroller Board

1. Electronic Speed Control Units (ESC)

It is an intermediator circuit responsible for driving high RPM BLDC motors. It takes PWM input from the microcontroller and replicates the same at the other end with distorted phases in 120 degrees so as to empower a three phase BLDC motor. Meanwhile it changes the frequency from 500Hz to 3-5KHz.It also has an inbuilt battery eliminator circuit to supply onboard components.

Figure 2. Electronic Speed Controller (ESC)

1. Brushless DC Motors (BLDC)

Brushless DC electric motor (BLDC motors) also known as electronically commutated motors (ECMs, EC motors) are synchronous motors that are powered by a DC electric source via an integrated inverter/switching power supply, which produces an AC electric signal to drive the motor.

2. Li-Po Battery

The Lithium polymer battery is responsible for powering up the 13000RPM BLDC motors with 5A current and 11.1 V supply.

3. XBEE 2.4GHz Wireless Modem

XBEE is a wireless modem by DIGI, under ZIGBEE 802.15.4 protocol to communicate between two wireless radios. It works on 2.4 GHz carrier frequency. It adopts Frequency Hopping Spread Spectrum technique (FHSS).

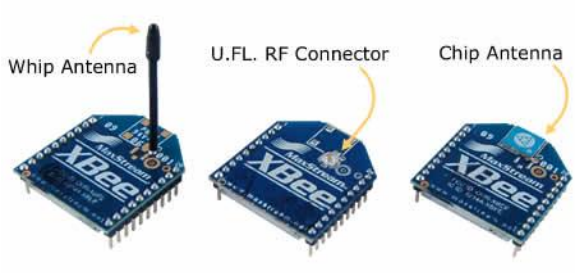


Figure 3. XBee Modules

4. USB Adapter for ZigBee

These are USB to FTDI convertor boards with Headers for ZigBee's basement. It also has pins fabricated for Breadboard mounting purposes.

5. IMU GY-80

It is a multi-sensor board. It has:

-Gyroscope
- Accelerometer
- Barometer
- Magnetometer
- Temperature Sensor

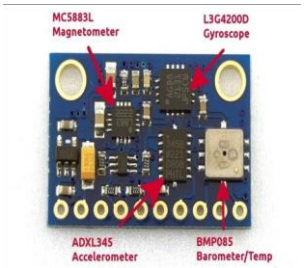


Figure 3. IMU GY-80 Board

IV. HARDWARE IMPLEMENTATION

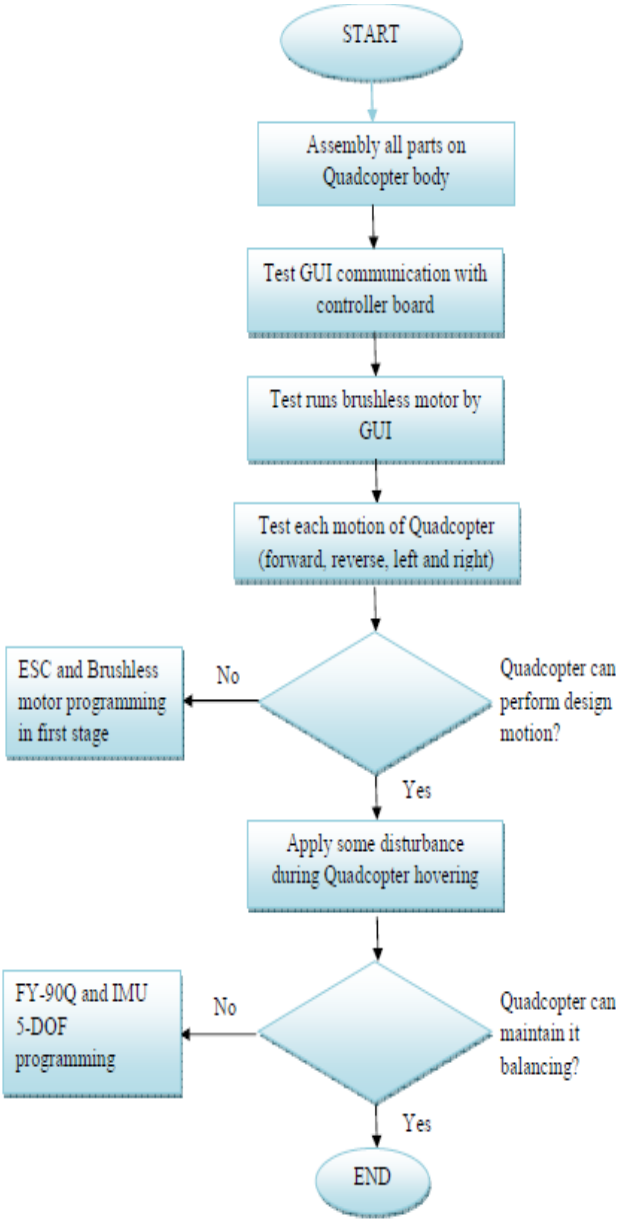


Figure 4. Flow chart of Quadcopter design.

We can use IMU-GY80 multi-sensor board in place of FY-90Q controller for gathering stability related sensor-data for a quadcopter and flight-control stabilization.

Flight-Control procedure for a quadcopter can be well understood by the following flow diagram:

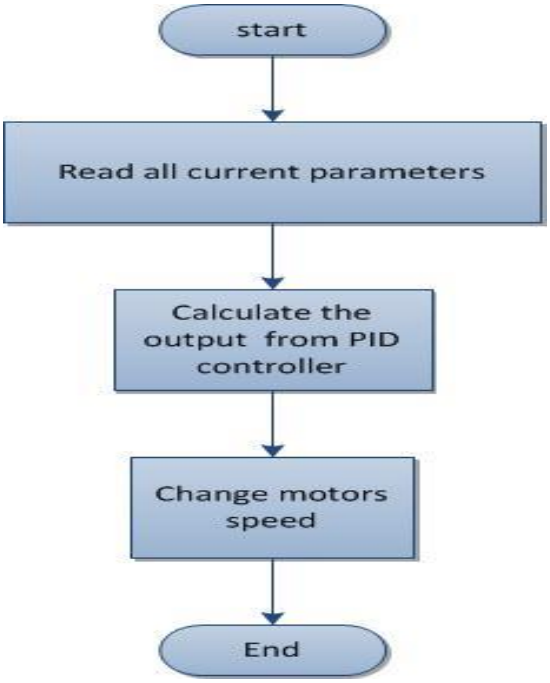


Figure 5. Flight control procedure

Various Sensors in IMU GY-80 board read the current status of quadcopter's position and alignment in air and those sensor values are operated for quadcopter's stability by the PID controller.

V. SOFTWARE IMPLEMENTATION

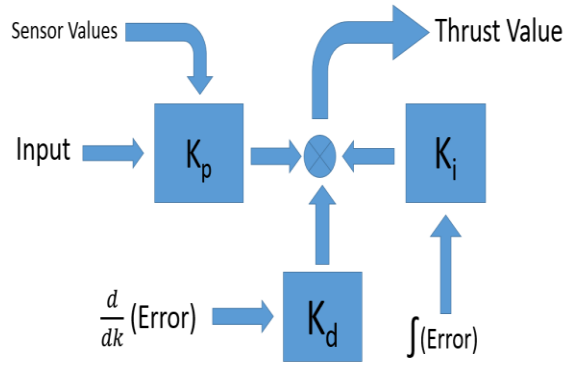
MATLAB stands for mathematical laboratory which is powerful tool for making GUIs and doing calculations.

Every BLDC motor is connected to an ESC. AN ESC stands for electronic speed control unit that gives 3 phase PWM signals to the BLDC motors to control the rotation of the motor.

This output PWM can be controlled using 50Hz pulse signal. It expects 5 to 10% duty cycles that dictates

output throttle from the min to max. Input throttle thus must be having T_{ON} of 100usec and 200usec marks the maximum throttle. Thus a GUI is made in a MATLAB and Arduino is linked with MATLAB as a software controlled slave. Thus, any action performed in MATLAB can be completely replicated in Arduino. And this entire procedure is made wireless. Now, the GUI is responsible for initializing the BLDC value and linking them to the Arduino board. Also, after this, there are 4 scroll bar that may values between 1000 to 2000. Thus each motor is allocated a scroll bar. Apart from this individual push button switches are employed to manipulate thrusts in each motor distinctly. In Arduino's server program, the program checks for input values (command signals from the user) if available, the action is taken accordingly. Also, then each angle value from the user is tallied with the sensor. Thus, a closed loop PID control system has been established that governs the positioning of the motor in 3-D space. Also, PID is responsible for manipulating and alerting the quadcopter's stances against any unwanted external disturbances.

Thrust=kp*(error) + ki (integral error) – K_d.



Thrust = K_p*(error) + K_i (integral error) - K_d (diff. error)

VI. CONCLUSION

We have implemented a quadcopter that can be distantly controlled by a User Interface interactive program. The intention is to build a GUI and give command signals to the Arduino that will be in command of the quadcopter. A PS2 controller (Gamepad) can also be used to implement the control feature to directly maneuver the quadcopter. The on screen measure is directly translated into values that refer to angle information. Any sort of disturbances are tackled in the PID to smoothen the movement and stay adamant to external disturbances. This way any remote user can log into the PC and run the code in the host and run the quadcopter to different places. Of course a visual feedback will be provided to have direct sight. FPV 5.8GHz is used for the same.

VII. ACKNOWLEDGEMENT

We acknowledge Dr. Atul Kemkar, HOD under department of electronics and telecommunication and our project guide Mrs. Preeti Hemnani, for their constant guidance and support that led us to work efficiently and complete this project in stipulated time without much hassle.

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RAILWAY TRACK CRACK DETECTION SYSTEM

Champakesh Gopal[1], Kishan Komalan[2], Nevin Mathew[3], Sibin Samuel[4]
Department of EXTC Engineering, SIESGST, Nerul, Navi Mumbai
1:champakesh.gopal@gmail.com, 2:kishank.2006@gmail.com, 3:nevinjmathews4@gmail.com, 4:sbnaul@gmail.com

***Abstract*—Railways form an integral and crucial part of the Indian transportation system. Millions travel by trains in India every day and its contribution to the annual revenue is immensely vital. In order to ensure the uninterrupted and smooth functioning and continued service to the commuters, it is essential to enforce regular checks on the tracks so as to ensure that mishaps don't occur and interrupt the service. Major hindrances occur due to defects in track and these can prove catastrophic. This project aims at addressing the issue of track surface maintenance by using the ultrasonic reflection. Consisting primarily of a moving contraption that detects flaws on the surface as it runs along it, the project aims at triangulating the location of the flaw and alerting the concerned authorities so that corrective measures may be taken.**

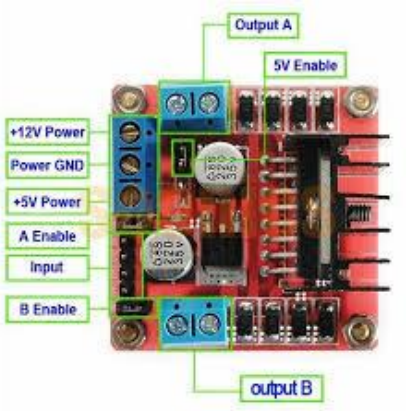
Keywords—component; formatting; style; styling; insert (key words)

I. INTRODUCTION

Transport is a key necessity for specialization that allows production and consumption of products to occur at different locations. Transport has throughout history been a spur to expansion as better transport leads to more trade. Economic prosperity has always been dependent on increasing the capacity and rationality of transport. But the infrastructure and operation of transport has a great impact on the land and is the largest drainer of energy, making transport sustainability and safety a major issue. In India, we find that rail transport occupies a prominent position in providing the necessary transport infrastructure to sustain and quench the ever-burgeoning needs of a rapidly growing economy. Today, India possesses the fourth largest railway network in the world. However, in terms of the reliability and safety parameters, we have not yet reached truly global standards. The principal problem has been the lack of cheap and efficient technology to detect problems in the rail tracks and of course, the lack of proper maintenance of rails which have resulted in the formation of cracks in the rails and other similar problems caused by anti-social elements which jeopardize the security of operation of rail transport. In the past, this problem has led to a number of derailments resulting in a heavy loss of life and property. Cracks in rails have been identified to be the primary cause of derailments in the past, yet there have been no cheap automated solutions available for testing purposes. Hence, owing to the crucial repercussions of this problem, we have worked on implementing an efficient and cost effective solution suitable for large scale application. We hope that our idea can be implemented in the long run to facilitate better safety standards and provide effective testing infrastructure for achieving better results in the future.

II. MODELLING OF THE PROPOSED SOLUTION

The contraption is automated and is designed to move on the surface of the tracks in such a manner so as to move along it and detect any defects present on the surface. Moving on precisely two DC motors that are powered by an L298N H-bridge, the bot can move in either forward or reverse direction depending on the voltage applied to the DC motors. However, our project will employ only forward motion. The RPM is controlled by the PWM pin of the Arduino.



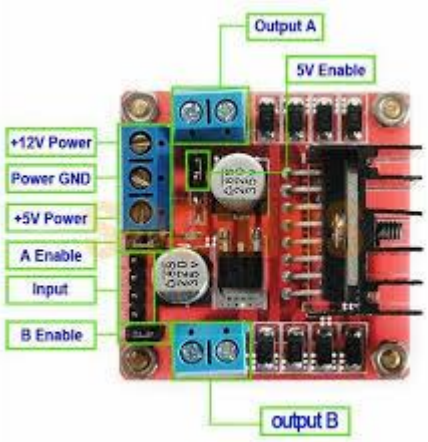
As shown in the figure, output A and output B are connected to DC motor A and DC motor B respectively. The ultrasonic sensor is mounted in front of the tip of the contraption such that it lies directly above the surface of the track. Once the arduino program begins, the mechanism begins to move forward halting only when a flaw is detected. The automation of this is advantageous because the maintenance and monitoring required is minimal.

A. Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

B. L298N H-Bridge Motor Controller



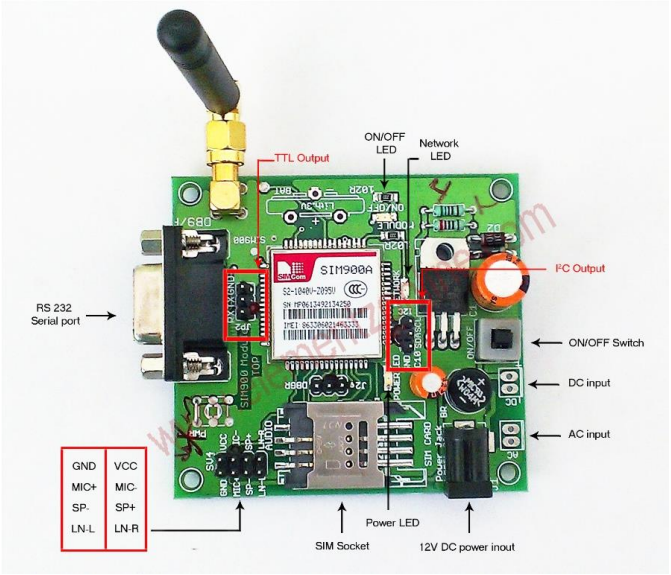
An H-Bridge is a circuit that can drive a current in either polarity and be controlled by *Pulse Width Modulation (PWM).

* Pulse Width Modulation is a means in controlling the duration of an electronic pulse. In motors try to imagine the brush as a water wheel and electrons as the flowing droplets of water. The voltage would be the water flowing over the wheel at a constant rate, the more water flowing the higher the voltage. Motors are rated at certain voltages and can be damaged if the voltage is applied to heavily or if it is dropped quickly to slow the motor down. Thus PWM. Take the water wheel analogy and think of the water hitting it in pulses but at a constant flow. The longer the pulses the faster the wheel will turn, the shorter the pulses, the slower the water wheel will turn. Motors will last much longer and be more reliable if controlled through PWM.

C. HC SR04

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm

D. GSM Module SIM900A



GSM/GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/ 1800 MHz. The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 chip (MAX232). The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface.

The onboard Regulated Power supply allows you to connect wide range unregulated power supply. Using this modem you can make audio calls, SMS, Read SMS, attend the incoming calls and internet etc. through simple AT commands.

E. GPS Module

- Tracks up to 20 satellites, with updates at least once a second
- Provides geo-location data for robots, vehicles, custom GPS units
- Receives signals outdoors or indoors* using a built-in antenna

*Indoor reception is dependent on location within the building, thickness of construction materials, and other factors. For the most consistent results, the GPS receiver should have a clear view of the sky.

The PMB-648 is a self-contained global positioning satellite (GPS) receiver, capable of providing accurate latitude, longitude, altitude, speed, heading, and other information useful for navigation. The data provided by the module is in the industry standard NMEA0183 v2.2 format, making it easy to interpret and use.

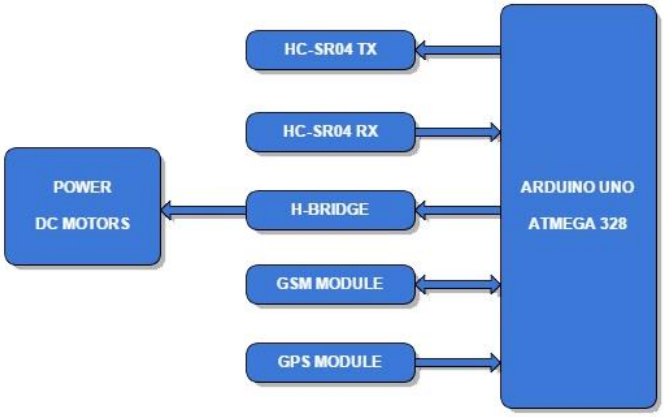
GPS data consists of text *sentences* that contain latitude, longitude, and other information. Each sentence consists of a prefix, plus one or more blocks of data, each separated by a comma. Using a microcontroller, you can parse each sentence to extract just the navigation information you're looking for.

III. IMPLEMENTATON OF PROPOSED SOLUTION

A. Equations

For calculation of distance in terms of centimeters.
The speed of sound is 340 m/s or 29 microseconds per centimeter.
The ping travels out and back, so to find the distance of the object we take half of the distance travelled.

B. Algorithm



The Arduino code gets compiled in the IDE and is executed.

- The contraption is powered on and follows a series of steps.
- The bot starts to move forward, as programmed, initializing a variable to the first value of distance so as to use that as reference. This point of course has to be flawless.
- By repeated reflections of ultrasonic waves, distance is constantly measured at intervals of
- The threshold condition is checked at every instant and whenever it is satisfied the mechanism continues to move forward.
- As soon as the threshold condition isn't satisfied, the bot stops.
- When this occurs, the GPS receiver immediately takes note of the latitude and longitude.
- This data is then sent to a SIM card using SIM900A.

C. Software

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software.

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