S. Y. M. Tech [Mechatronics] 2016-17

Dissertation Phase - II Abstracts

1. Performance Enhancement and Data Analysis of Bottle Filling Plant

Ankita Sanjeev Chaudhari (MIS: 121594001)

Guide: Prof. S. D. Agashe, Department of Instrumentation and Control

Process control, design and optimization are the key features of any industry and continue to improve because of highly increasing global competition. Every industry is keen to increase their yield with minimum possible resources. Customers desire for efficiency and quality improvements. Industrial manufacturers can best serve their customers by designing tools and strategies that improve the efficiency, costs, and performance of factories and other capital projects.

Productivity is defined as the ratio of the output to input of a production system. With a given input if more outputs of products or services can be produced, then higher productivity/ efficiency is achieved. Efficiency is doing the things right or it is the measure of the relationship of outputs to inputs and is usually expressed as a ratio. Effectiveness is doing the right things and measures the output conformance to specified characteristics.

The objective of this project is to enhance the performance of the existing pilot plant and increase its effectiveness and efficiency.

2. Assembly line automation and retrofitting of conveyor system

Chandore Amol Pundlik (MIS: 121594002)

Guide: Dr. M. D. Jaybhaye , Department of Production Engineering and Industrial Management

Assembly line consists of two different systems one is assembly machine and other one is testing setup. Rotary indexer Assembly machine is used two assemble the connectors which consist of Body of the connector, seal and retainer for locking purpose. Different stations are designed according to the requirement of component. Bowl feeders are used to feed and alignment of the components.

Power packer testing unit is designed for checking the continuity of the power packer sensor by Hall Effect using pneumatic cylinders. The system improves the accuracy and precision of the process, time required is also got reduced and hence the manpower required get reduced.

There are two different type of set up to be retrofitted in this project one is linear and other is rotary. Linear conveyor is driven by chain drive and that of rotary conveyor is driven by Belt and pulley mechanism. All the equipment from the existing set up are cleaned, repaired and painted. Electrical motors are checked and made in running condition. Three positions are identified in linear conveyor and according to that limit switches are placed. The system is driven by AC Synchronous motor and controlled via relays and PLC unit. Potentiometer is used to vary the speed of the conveyor.

In rotary conveyor two motors are used. Three phase induction motor is used to drive the conveyor connected by belt and pulley mechanism. Servo motor is used to hold the work piece at desired position. This system is controlled by using timer set in the PLC. DELTA PLC is used to control the both systems.

Special arrangement is made for safety in both type of conveyor by using Emergency Exit buttons, LOTO is also used for maintenance safety. Warning Lights and Alarm is also installed to indicate different operations if system.

3. Development of electronic control board for 3D printing

Desai Rupesh Ravindra (MIS: 121594003)

Guide: Dr. (Mrs) A. V. Mulay, Department of Production Engineering and Industrial Management

This project is aimed at development of the electronics control board for the 3D printing process. Rapid prototyping is the most recent manufacturing process aimed at development of prototypes at fast speed and low cost. Electronics control board is one of the main factor which decides the speed and accuracy of the process. The project is mainly divided in two parts 1) Understanding of the control algorithms for the 3d printing process, 2) develop the electronic control board for the FDM and SLS process using the openware resources and control algorithms. Control algorithms and process parameters are studied from the research papers available, Since FDM machine is open source along with the various firmware available for the programming. These firmwares are studied for the development of the control algorithm for SLS process. The control program is developed so that user can add new facilities through macros if required in SLS machines. Parameters controlled through the electronics hardware in FDM machine are bed temperature, nozzle temperature, Cartesian limits, speed and federate control. The various firmwares were studied and Marlin firmware was chosen for the programming of the FDM based printer. Electronics equipment were chosen accordingly the requirements of the system i.e. microcontroller, drivers, sensors etc. Developed control board is tested with experimentation and then it is validated, the control program can be easily modified according to the process requirements. The various material and LASER properties can be added to the control algorithm after experimentation.

Keywords - FDM, SLS, firmware, LASER, 3D printing

4. Design, development and validation of mechatronic testing and control systems for automatic air vent

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Guide: Dr. S. M. Patil, Department of Production Engineering and Industrial Management

Automation and robotics application is being an emerging field in Industry and at the same time the need of the same has been increased exponentially due to ease of work and speed of process. The advancements and technology has been measured in terms of control, life and robustness of system. The application of hydraulics, pneumatics and electrical system for actuation are most commonly implemented according to different application. Electronic control and sensor technology has taken a greater leap towards it due to advancement in micro fabrication technology and low power consumption. Integration of all of these elements is used to develop, redesign, reengineer or retrofit a mechatronics system. The objective of this project is to re-engineer and implement the effort testing machine of such integrated technology to increase the accuracy in Air vent effort testing with reduced human errors.

The Effort testing machine is used to measure the efforts required to move the knob and wheel of air vent. Result is generated based on whether effort values are within tolerance limit or not.

A Load cell attached at manipulator is used to measure the force required for six movements of air vent and a 6-axis robot is used to give this movement. For accuracy of measurement Load cell is calibrated using reference force measurement device. To maintain the repeatability of measurement the robot has been programmed in such a way that it will not slip over knob while it is moving the knob. The secondary objective of Effort testing machine is to check metal clips attached to air vent housing. The photoelectric sensors are used to check clips attached to air vent. Limit switches and Pneumatic cylinders are used to detect the part and clamp the part.

The control of whole operation is carried out by PLC (Programmable Logic Controller). A new method of measurement of efforts for air vent control knob using combination of operation for automation is defined in this project.

The total cycle time for checking of one air vent is reduced from 45 sec to 34 sec and man power reduced from 4 to 2 per shift with formation of cluster of 3 work stations. The zebra printer is also part of ETM. To track the manufactured Air vent a sticker with barcode, effort values and part description is printed with zebra printer which is controlled by PLC. Gage R and R (Repeatability and Reproducibility) is used for the validation of effort testing machine.

Also, an attempt has been carried out to automate the manual operation of airvent. Prototype was developed and tested with the help of stepper motor, controller, bluetooth communication and the user interface.

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5. Sensor less Trapezoidal BLDC Motor control

Neve Yogeshwar Mohan (MIS: 121594006)

Guide**:** Prof. B. B. Ahuja, Department of Production Engineering and Industrial Management

In the present-day scenario, the fuel diminishing is the biggest challenge in front of us for searching other energy resources for running out our vehicles. The E-vehicles that is Electrical vehicles are the significant outcome and cures over such an issue. All E-vehicles uses the induction motor or BLDC motor. But induction motor is asynchronous while BLDC motor is synchronous motor, hence mostly used in automotive industries. Being electronically commuted motor, it is required to know rotor position in BLDC Motor to apply proper commutations for further proceeding of the motor rotation. In present days, this all BLDC motors are controlled by using hall sensors or other position sensors. These sensors provide the rotor position to the controller and depending on the position of the rotor the commutation will be applied over the inverter input of the motor. By this method motor comes in continue rotations. But in sensor less BLDC motor control we neglect the use of any type of position sensor in the motor. The motor rotor position in the Sensor less BLDC motor controller can be detected by the sensing of back EMF. This report presents the simulation of sensor less controlled operation of Brushless direct current (BLDC) motor. The position sensor less BLDC drive simulated. In this thesis it is based on the concept of zero crossing point estimation from the terminal voltages differences. Without using any type of rotor position sensor, we can control the motor rotation. It is shown by experiments and mathematical calculations, that this difference of line voltages provides an amplified and opposite version of the back EMF at its zero crossings. The commutation signals are obtained without finding out the motor neutral voltage point. The effectiveness of this method is demonstrated through Mat lab Simulink simulation.

Keywords— Sensor less BLDC motor control, Hall sensors, Back EMF, Zero crossing points, Mat lab Simulink.

6. Design And Development Of 3D Stereoscopic Files Visualization Software

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Guide**:** Prof. B. B. Ahuja, Department of Production Engineering and Industrial Management

Stereoscopic visualization is the simplest form of virtual reality in which 3D image can be displayed interactively at a personal computer. Stereoscopic Visualization combines latest stereoscopic display technologies with a robust machine which will handle large amount of data and permit it to be manipulated interactively in real time. Stereolithography machines such as 3D printers can build any shape as a series of triangles. These machines require a series of closed two dimension contours which are stuffed together with coagulated material because the layers are collectively connected. STL file is capable of displaying a polyhedron with every polygonal shape. In realtime ,it is solely used for triangles. To properly become a 3D volume, the surface pictured by any STL files should be closed and connected, wherever each edge is an element of precisely two triangles, and not intersecting each other. The proposed system is designed to visualize 3D files such as .stl and can perform operations like zoom, 3d rotation, Boolean operations, and export as .stl file etc. on it. STL and it is a file format used to describe shape of the 3D object. The software documented below imports stl files such that we can visualize that stl file in 3 dimensions on our computer screen. We can perform certain required operations on that stl file and can also export it with an extension .stl .This exported file can again be used in 3d printer to get the desired 3d model .

Keywords - Stereolithography , .Stl files , 3D printers, Matlab.

Publication: Design And Development Of 3D Stereoscopic Files Visualization Software, International Journal of Engineering Science and Computing, Vol 7, Issue No 6, June 2017,ISSN 2250 1371 © 2017 IJESC

7. IoT based solid waste management system for smart city

Nirde Krashana Dnyanoba (MIS: 121594008)

Guide: Dr. U. M. Chaskar, Department of Instrumentation and Control

In the present day scenario, many times we see that the garbage bins or Dust bin are placed at public places in the cities are overflowing due to increase in the waste every day. It creates unhygienic condition for the people and creates bad smell around the surroundings this leads in spreading some deadly diseases & human illness; to avoid such a situation we are planning to design “IoT Based Solid Waste Management System for Smart Cities”. In this proposed System there are multiple dustbins located throughout the city or the Campus. These dustbins are provided with low cost embedded device which helps in tracking the level of the garbage bins and an unique ID will be provided for every dustbin in the city so that it is easy to identify which garbage bin is full. When the level reaches the threshold limit. The device will transmit the level along with the unique ID provided. These details can be accessed by the concern authorities from their place with the help of Internet and an immediate action can be made to clean the dustbins.

***Keywords*—** Internet of things, 16F877A Pic Microcontroller, IR sensors, RF transmitter, RF receiver. And GSM.

Publication: IoT based solid waste management system for smart city, International Conference on Intelligent Computing and Control Systems (ICICCS 2017), 15-16, June 2017, VAIGAI College of Engineering, Madurai, 625122, TN, India.

8. Design and Mathematical Modeling of Unmanned Aerial Vehicle

Patankar Madhavi (MIS: 121594009)

Guide**:** Dr. Rajiv B., Department of Production Engineering and Industrial Management

This thesis is dedicated to Designing of quadcopter and exploring autopilot. Autopilot is a brain of any autonomous vehicle. The vehicle should have sense of it's position, dynamics and constraints. In this thesis we have tried to explore 6 DOF model for Quadcopter. Path planning is essential for UAVs that travel in different terrains. Designing feasible path planners for UAVs taking the dynamic constraints is diffcult. In this thesis, we develop a 3D path planner using A star algorithm for a quadrotor. The algorithm has been implemented on Pixhawk (autopilot). Simulation results are presented to validate our approach.

Keywords - Autopilot, Quadcopter, 6 DOF model, A star algorithm, Pixhawk

9. Development of vibration shaker for squeak and rattle test

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Guide: Dr. M. D. Jaybhaye, Department of Production Engineering and Industrial Management

The main purpose to develop the test set up is, to provide vibration to the Air-Vent assembly and measure the noise created by rattling of vents due to it. A vibration shaker is a device used in vibration testing to excite the structure. There are many engineering applications for a source of controlled vibrational excitation. Vibration profiles are like sine, random, shock etc. Testing of any part requires a source of controllable vibration.

Commercial vibration systems, often called shakers, typically use an electromagnetic voice coil assembly to move the test fixture. Voice coils can also be found in common audio loudspeakers. The construction of automobile subwoofers is particularly rugged. A very useful vibration test fixture can be created by modifying a subwoofer to include a table area to which a reference accelerometer and the component under test can be mounted. Microphone is used to measure noise. DUT in this project is air-vent in car. Air-vent mounted on the vibration shaker.

The main issue of this project is ambient noise and machine noise should be less. Many of vibration systems having its own noise, so the main challenge is to make silent shaker and to make ambient noise minimum. Main noise contributing part for electro-dynamic vibration shaker is blower. Elimination of blower is nothing but the making silent shaker. So in this project made some arrangement to make silent shaker. This report describes the design, construction and application of a customized vibration shaker by the reference of subwoofer-based system and electro-dynamic vibration shaker. Vibration testing is accomplished by introducing a forcing function into a structure, usually with some type of shaker. Alternately, a DUT (device under test) is attached to the "table" of a shaker. Vibration testing is performed to examine the response of a device under test (DUT) to a defined vibration environment. The measured response may be fatigue life, resonant frequencies or squeak and rattle sound output. Squeak and rattle testing is performed with a special type of quiet shaker that produces very low sound levels while under operation. The vibration given to the air-vent and rattling noise recorded by microphone.

10. Implementation of image processing library for visual inspection head

Pramod Madhukar Ahire **(**MIS**:** 121594011)

Guide**:** Dr. Rajiv B., Department of Production Engineering and Industrial Management

Most of the Industrial and Agricultural sectors in India employ manual labors to carrying out various operations instead of automation. Although Nowadays, Automation had led into the industries. But still it needs to be modified to be a smarter intelligent system. Like lots of manual interventions are required especially in the grading and sorting of objects. Because inspection of any object for quality and identifying defective ones by manual inspection is a difficult task and often fails. But in the field of automation there are various types of libraries which is use to carry out different types of operations. In every task to carry out different operations requires different types of libraries according to the type of task and compatibility of platform which is based on computer vision. This gives rise to concept of Implementation of Image Processing Library for Visual Inspection Head to modernize the Agricultural and Industrial areas and to meet their quality standards. The project is to create Visual Image Processing Library which is collection of number of predefined functions which can be used in any program and system which i compatible for execution on any embedded platform.

Keywords - Automation, computer vision, image processing library, embedded system.

Publication : Implement Image Processing Library for Visual Inspection Head, International Journal of Engineering Science and Computing, June 2017, 12923-12925. ISSN 2321 3361 © 2017 IJESC

11. Development and Validation of Effort Testing Machine and Automation of Airvent

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Guide: Dr. M. R. Dhanvijay, Department of Production Engineering and Industrial Management

The project is aimed at developing a multisensory module that combines three sensors viz. Resistance Temperature Detector, Thermocouple and Frequency Measurement Sensor. In the later stage, we have added four more sensors viz. Accelerometer, barometer, Gyrometer and Magnetometer which will act as an inertial measurement unit and altimeter. There are products available in the market with such specifications but high cost is the main concern.

The concept is mainly aimed at integrating sensors in order to produce precise output and to make the module cost effective and compact. The development and integration of sensors in this module will find applications mainly in the process industries, naval applications, on board diagnostics etc. The newly added sensors to the board i.e. Accelerometer, barometer, Gyrometer and Magnetometer will find applications in motion activated devices, free-fall detection, intelligent power saving for handheld devices, automated appliances and robotics, display orientation, gaming and virtual reality input devices, motion control and IMU inertial measurement unit & AHRS etc.

The device can be specifically implemented in Drones or flights for flight stabilization control and to measure the height of the flight. I2C (Inter-Integrated Circuit) bus is used for the fast operation of the device as which uses only two wire lines and supports multi master configuration. Also major significance of I2C serial bus is that, it makes it simple to integrate multiple sensors in the same system. The module combines a tri-axial accelerometer, Digital barometer, Gyrometer and tri-axial magnetometer which are manufactured using specialized micromachining (MEMS) processes with a separate CMOS chip that provides the interfaces between the modules and the host system. This design approach provides a dedicated interface circuit that is trimmed to better match the sensing element characteristics.

In this case, the pressure sensor would be used to measure a relative change in pressure over a short period of time to indicate a change in altitude, thereby fully positioning the handheld device in three-dimensional space.

Keywords **-** Multisensory module, Micro-controller, Sensor IC's, RTD, T/C, Frequency.

12. Simulation and Analysis Of Injection Molding Machine Towards The Concept Of Health Monitoring

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Guide: Mr. S. U. Ghunage, Department of Production Engineering and Industrial Management.

The main aim of the report is to illustrate the activity around the globe in the way of research, development and application of techniques for health monitoring of machines. The paper initially discusses the necessity for planned maintenance, the extension of this into condition based maintenance and the necessity for health monitoring. It then discusses some terms relating to this field and in particular differentiates between firm and questionable faults and the reason the latter can be used for prediction, whereas the former is easier to diagnose.

The dissertation tries to restrict itself to the deeper understanding of health monitoring of the machines. There is some discussion of research into tool or process monitoring although many areas of this type of work cut across that of the machine itself ambiguous. For this reason there are notes on area of tool for monitoring where these have techniques and expertise which lend themselves to the machine itself. There is a discussion on on-line and off-line monitoring followed by a brief survey of the automatic monitoring presently available on machines. Much of this is related to firm fault diagnostics but there are signs that questionable faults are now being monitored. The paper then describes methods for the choice of parameters for health monitoring and their data acquisition. Two large sections then follow on fault monitoring and diagnosis of both types of faults where much reference is made to recently completed research including application of neural networks, expert systems and fuzzy logic. The document concludes that the area of health monitoring is being seen as of increasing importance. All available techniques have their drawbacks, all are not absolute and there is a plea for more information as to how real faults develop and exhibit themselves in measured parameters.

In this report injection molding machine is used as an example for health monitoring. Further research is made on how to conceptualize health monitoring of machine with the help of Cloud based platform.

13. Development of Air Flow Performance test setup for Automotive Air comfort system

Satti Kunal Dutt (MIS: 121594014)

Guide: Dr. S. M. Patil, Department of Production Engineering and Industrial Management

Section I The Automobile cabin when on road is subjected to vibration from different sources external to the cabin. These sources include the:

- Engine Vibrations: The engine of the automobile produces the rotational power necessary for its motion. During this process, some vibrations are produced along with it which in turn can propagate throughout the vehicle body and cause it to vibrate along with it. ·
- Road Vibrations: The vehicle is isolated from the road with the help of Suspension systems, which is a flexible link between the road and the automobile preventing the shocks from directly being transferred to the cabin. The road shocks may not be completely damped.

These vibration if present in the cabin may cause the interior components to vibrate. Under the influence of vibration, the interior components may produce some rattling noise. The resulting noise may cause discomfort to the passengers, which is undesirable.

The objective is to subject the Automotive airvent on the assembly line to Automobile cabin vibration, measure the rattling noise produced from the product and give conformance accordingly whether the product has passed or failed. The product will be failed if the noise is produced above a certain sound level.

The test station along with the product holding fixture should produce noise less than 32 decibels (dB) when subjected to vibrations. But the assembly line has a noise level of 85-100 dB which may interfere with our test results so an acoustic isolation system is being used. The acoustic chamber constructional factors and technicalities are also discussed in the report.

Commercial vibration systems, often called shakers, typically use an electromagnetic voice coil assembly to vibrate the test fixture. Voice coils can also be found in common audio loudspeakers. A very useful vibration test fixture can be created by

modifying a subwoofer to include a table area to which a reference accelerometer and the component under test can be mounted. Microphone is used to measure noise.

The Buzz, Squeak and Rattle (BSR) test system uses the newly developed vibration shaker to have a complete system solution, which includes the Sound Data Acquisition (DAQ) system as well the acoustic isolation system. This report gives a brief idea about:

1. Design and development of the BSR test station,
2. Selection and technical specifications of the components used and
3. Validation of the test station.

The test station has to be established on the assembly line, therefore it has to have minimum test cycle time. Hence, the fixture design requirements and factors are discussed in this report along with listing of some preliminary concepts.

Section II The Automobile Air comfort system is a compact arrangement of different components to provide comfort for passengers inside the car-cabin. It maintains and regulates different parameters of air such as temperature, air velocity as well as humidity in some cases, within desirable ranges for passenger comfort. It includes the following three elements:

1. Heating Ventilation and Air Conditioning, HVAC system
2. Air distribution ducts
3. Air-vents The air while flowing across these arrangements undergoes a considerable change in its parameters like volume flow rate and pressure, these parameter changes are monitored in the following tests:

Air Leakage test: In this test, the Device Under Test (DUT) is supplied with a specific Gauge Pressure under closed conditions, the correspondingly measured flow rate, points out to the leakage across the product.

Flow Pressure drop test: The air when flowing across the ducts or air-vents, at a particular flow rate, undergoes pressure drops at different joints and cross-section change. Thus, the Flow Pressure drop test includes measurement of pressures at specific points and its acceptability is verified with test standards.

Air flow Directivity test: This test is reserved for automotive air-vents only. In this test, the flow direction as per the different vane orientations which directs air to

passenger's specific body points. The end result gives us air-flow distribution performance of the DUT Air-vent specific to the passenger's position in car-cabin. Thus, this test bench covers the above stated air flow performance capabilities of Automotive Air distribution system inside a car-cabin. The different Original Equipment Manufacturers (OEMs) have different limits to these parameter, to maintain the product desirable to the customers, which are defined in their individual test methodologies and requirements.

Keywords - Vibration shaker, Data Acquisition, Air Flow performance test.

14. Automation of Plastic Plating Process

Shinde Anup Anil (MIS: 121594015)

Guide: Mr. M. N. Shaikh, Department of Production Engineering and Industrial Management

In industries the need for automation and robotics applications has increased exponentially due to development in technology, to be competitive in market and to deliver solutions to customer at fast pace. The advancements and technology has been measured in terms of control, life and robustness of the system. The objective of this project is to automate plastic plating process by designing and installing mechanical assembly which is controlled electronically.

The temperature controller is built, to maintain baths at some specific temperature. Pt-100 is used as sensor to monitor temperature which sends signals to microcontroller (Ardiuno UNO) which processes information and controls power supplied to heater to maintain temperature of bath.

The mechanical assembly consist of horizontal slider attached with belt drive for X-axis movement. Lead screw is used for Z-axis movement. Motors are used for actuation which is controlled by microcontroller according to instructions by user.

Keywords - Temperature Controller, Pt-100, Arduino, Electroplating

15. Real Time Ergonomic Data Capture and Analysis

Tembhare Tushar Ramesh (MIS: 121594016)

Guide**:** Dr. P. D. Pantawane, Department of Production Engineering and Industrial Management

Thesis describes about real time ergonomics data capture and analysis throughout the cycle. Number of sensors will interface to operator at recommended positions. These sensor will transmit data to the Arduino microcontroller. Calibration of sensors has been done by programming the controller with the help of experimental raw output obtained from the respective sensors. Once we have parameters collected from the sensors, statistical analysis and validation has been carried out to verify the results. As we understand, ergonomic analysis becomes very crucial while designing workstation. Properly designed workstation with ergonomic standards, will ultimately increase productivity and also reduces operator problems. As of now, industries rely on visual tools to analyze ergonomic level of workstation or assembly stations. There are no tools available for collecting bending angles, metabolism rate, vibrations from machine to operator, etc. By collecting such data in real time environment, we can validate actual ergonomic level of station. Use of these sensors provide lower back compressive forces, metabolic energy expenditure of operator using standard formulas. From the literature review and background history, it is cleared that maximum health issues reported on the manufacturing units are related to lower back pain. For reducing the health issues, there must be some simple design which allows us to reduce risk involved in earlier stage. This will in turn improve productivity and working environment on shop floor. Also, metabolic energy expenditure and vibrations face by the operator are monitored in real time environment.

16. Hardware in loop implementation of different motors and motor controllers for automotive applications

Varun Ashok Kumar (MIS: 121594017)

Guide: Mr. J. S. Karajagikar, Department of Production Engineering and Industrial Management

There has been a major shift in the automotive industry towards greener technologies and lesser fuel consumption. This has been due to both regulations and consumer demands. The automotive industry has been changing rapidly. Almost all automobile companies are coming up with an electric variant to at least one of their models. It may be a hybrid or a fully electric vehicle. But the motors that have been used to power these vehicles have been different for different companies. This project deals with the study of four of the most popular motors used for electric vehicle powering and finding out which kinds of motors are appropriate for different performance ranges of vehicles. It involves the mathematical modeling of each type of motor, designing a control algorithm for each and simulating them in Hardware in Loop setup at the HIL Lab facility at Automotive Research Association of India (ARAI) Pune. The four motors involved in the study are 3 phase induction motor (IM), Brushed DC motor, Brushless DC motor (BLDC), and Permanent Magnet Synchronous motor (PMSM).

17. Design, Development and Cost Reduction of Top-line Bag Filter for Paint Industry

Bhagwat Rupa Suresh (MIS: 121594018)

Guide: Dr. S. S. Ohol, Department of Mechanical Engineering

Design and development are the key features of any industry and continue to improve because of highly increasing global competition. Every industry is keen to increase their yield with minimum possible resources and money. This project plays a very important role in designing, developing and costing out for the company.

Top-line bag filter is basically a filter with inlet flow coming from the top. it is called a bag filter because the filtration process is performed through a bag which is made up of metallic filter net. The bag is inserted into the vessel which can be removed for cleaning. The filter used is of the size 10 micron.

Topline bag filter is designed specifically for paint industry with specifications as 10 bar maximum pressure and 100 degree celcius maximum temperature. The filter design will require mathematical calculations with material selection and stress requirements. All the calculations are made in Mathcad software. The modeling is done in modeling software Pro-E. Simulation and analysis is done in Ansys. Finally by manual calculations the cost out analysis is completed.

The objectives of this project are to study the filter design and filtration process in detail and to develop a model which will be cost effective and will help to enhance the performance of the process.

S. Y. M. Tech [Mechatronics] 2015-16

Dissertation phase - II Abstracts

1. An optimized path finding technique using digital image processing and Genetic algorithm

Sharan Vhanale (MIS: 121494001)

Guide: Dr. S. B. Mane, Department of Computer Engg.

The path planning is important issue of mobile robots. Its task is to find a collision free path from the start position moving to the target position with reasonable algorithm. The scheduling and planning is well known NP-Hard (NP-Complete) problem. Autonomous robot vehicles can be used in variety of applications including space exploration, weaponry, household and transportation. Algorithms used for motion planning are distinguished by two features:

1. Whether environment is known or unknown.
2. Whether it is a static or dynamic environment.

Path planning is carried out by two methods

1. Reactive Path planning: In which path is computed after the robot starts.
2. Global Path planning: Path is computed before the robot starts.

In known static environment path planning algorithms used are Sub Goal network, A* algorithm, D* Star algorithm, Artificial Potential Method which are classic and heuristic search methods. The above mentioned classic and heuristic algorithms have some drawbacks such as local minima, deadlock of robot, oscillation of robot. Considering all these drawbacks of classical algorithms we have to design an algorithm which will overcome them. There is also some memory and processing constraints in microcontroller based solutions. Here we propose the concept of deformation properties of obstacles such as bush, curtain using image processing and Finite Element Method. This will give the deformation cost (measurement of strain) of obstacle based on which robot will decide to change path or deform the obstacle by applying force.

Keywords: Artificial Intelligence, Genetic Algorithm, Robotics, Path Planning

2. Design and development of Automated sorting electro-pneumatic trainer with electronic and PLC control

Madhujit Kulkarni (MIS: 121494002)

Guide: Dr. S. M. Patil, Department of Production Engineering and Industrial Management

In Industries the need for automation and robotic applications has increased exponentially due to ease of work and speed in process. The application of Hydraulic, Pneumatic and Electrical systems for actuations are most commonly implemented according different applications. The advancements and technology has been measured in terms of control, life and the robustness of the system. Electronic control and Sensor technology has taken a great leap towards it due to advancement in micro fabrication technologies and low power consumption. The objective of this project is to give practical approach in small scale implementation of such integrated technology by using a simple sorting station.

The project is designed to differentiate and arrange the objects according to size, height, color and shape using different sensors, which uses integrated electrical and pneumatic actuators for sorting. Ultrasonic sensor/Laser diode is used to detect height. TCS3200 module used to find the color of the object. Inductive sensor is used to differentiate metal and non-metal objects. The objective is to store the data of properties of the object detected by the sensors and sort them by using a Pick and Place robot at the receiving end in specified location. The control of the whole operation is carried out by either Microcontrollers (Arduino Mega 2560 board) or PLC systems which use a soft PLC system as compared to a conventional hard PLC. For this purpose software knows as Automation Studio 6.1 has been used. The ladder logic has been interfaced to actual I/O box using this software. The trainer achieves an average sorting rate of 68 objects per hour.

3. Retrofitting and Up-gradation of Slideway Grinding Machine by Design and Implementing of Mechatronics System

Sangale Navnath Machhindra (MIS: 121494003)

Guide: Dr. M. D. Jaybhaye, Department of Production Engineering and Industrial Management

Replacement of the high value machine tool or special purpose machine tool is not financially feasible and the machine has a large work envelope with high quality and substantial machine components. Slide way grinding machine manufactured by Waldrich Coburg Company in 1994, is a very expensive machine with high precision of work. It's having a problem of vertical axis falling down by 10-15 mm due to gravitational force at the time of working.

The retrofitting of grinding machine by replacement of previous worm pair with a self-locking one has led to elimination of prevailing problem of falling of axis as well as has raised the quality standards of machine tool. It has enhanced the accuracy, repeatability and dimensional stability of machine tool tremendously.

As the retrofitting of grinding machine was done by replacing worm gear pair, the set up cost involved was negligible as compared to the cost of investment in new machine. Retrofitting has led to higher production rates; it has made the machine tool suitable for mass production. Accuracy of a job manufactured on retrofitted grinding machine is approximate 17 micron and hence the repeatability and dimensional stability of manufactured part is achieved. After retrofitting, it's working very precisely and results obtained are tremendously good. Now vertical axis is working with a very high reliability & accuracy and it doesn't fall down in any condition.

***Keywords*:** Retrofitting, Grinding Machine, Vertical Axis, Worm Gear

Publication: "*Retrofitting of machine by design and implementation of self locking of worm gear for vertical axis*", Int. Journal for Scientific Research and Development, Vol 4 Issue 3, May 2016

4. Development & Analysis of Telescopic Mast Which Holds A Camera For Riot Surveillance Vehicle

Pratik Vilas Gangurde (MIS: 121494004)
Guide: Dr. S. S. Ohol, Mechanical Engineering Department

This report covers discussions on development & analysis of riot surveillance system with rapid deployment of the telescopic mast setup for surveillance. The mast will be lifting a high definition camera to a height of up to 12 feet and the complete assembly will be fixed within a vehicle having a roof opening door through which the setup for surveillance may be deployed. A novel technology of using rack and pinion for extension of telescopic cylinder is also introduced. The control system deploys or extends the setup from a lower position within the vehicle to an elevated position extended through the opening of the roof door high above the opening of the vehicle. The vehicle has a telescoping mast having a telescoped retracted position. The telescopic mast will be operated manually with the help of rack and pinion. A mast operator moves the mast between the telescoped retracted and extended positions. Image processing device is a high resolution camera. The camera is attached at a pan device. Pan device may be any conventional device for rotating the camera three hundred and sixty degrees about the longitudinal axis of mast. A cable line which would be an interface between the rotation control system and the camera will extend with the telescopic mast and will be wound around a cable coiling mechanism. The vehicle can be used by various government forces for multiple uses, such as collecting video evidence of culprit during riots, surveillance purpose to check the area to maintain law and order in the same. The structural analysis is done using software like Catia V5R21, Altair HyperMesh OptiStruct, for structural strength analysis of the telescopic mast.

This developed system is a better solution as a user friendly, economic and compact in size while performing dynamic video shooting for surveillance purpose.

5. Neuro Fuzzy Controller for Navigation of Mobile Robot

Sagar P Jain (MIS: 121494005)

Dr. M. S. Sutaone, E&TC Engineering Department

For any autonomous mobile robot, navigation is most basic functionality which should be performed in reliable as well as intelligent way since it needs to travel through unstructured and partially or completely unknown environment like mines, caves, hilly regions. Dealing in this environment, an intelligent algorithm is required which must be capable of deducing inferences. It avoids the robot to be fall in traps based on data given to it through sensor systems. In this project, a combination of Fuzzy Logic system and Artificial Neural Network is used to provide an algorithm which can guide robot. Such algorithm will be having pros of both the intelligent methods, while avoiding the cons to great extent. Simulation of the algorithm will be done to demonstrate merits of system. In addition to this a prototype of robot will be developed. The comparison between simulation result and real time result will be carried out. The result will be analyzed depending on the comparison.

Keywords: Navigation of mobile robot, Fuzzy logic, Artificial Neural Network, Neuro-fuzzy system.

6. Small Scale Automated sorting and production line electro-pneumatic trainer with electronic and PLC control

Sai Kartheek Bandi (MIS: 121494006)

Guide**:** Dr. S. M. Patil, Department of Production Engineering and Industrial Management

In Industries the need for automation and robotic applications has increased exponentially due to ease of work and speed in process. The application of Hydraulic, Pneumatic and Electrical systems for actuations are most commonly implemented according different applications. The advancements and technology has been measured in terms of control, life and the robustness of the system. Electronic control and Sensor technology has taken a great leap towards it due to advancement in micro fabrication technologies and low power consumption. The objective of this project is to give practical approach in small scale implementation of such integrated technology by using a simple sorting station.

The project is designed to differentiate and arrange the objects according to size, height, color and shape using different sensors, which uses integrated electrical and pneumatic actuators for sorting. Ultrasonic sensor/Laser diode is used to detect height. TCS3200 module used to find the color of the object. Inductive sensor is used to differentiate metal and non-metal objects. The objective is to store the data of properties of the object detected by the sensors and sort them by using a Pick and Place robot at the receiving end in specified location. The control of the whole operation is carried out by either Microcontrollers (Arduino Mega 2560 board) or PLC systems which use a soft PLC system as compared to a conventional hard PLC. For this purpose software knows as Automation Studio 6.1 has been used. The ladder logic has been interfaced to actual I/O box using this software. The trainer achieves an average sorting rate of 68 objects per hour.

7. Power Measurement Using Microcontroller Based System for Efficient Power Management

Prasad Kharate (MIS: 121494007)

Guide**:** Mr. M. R. Dhanvijay, Department of Production Engineering and Industrial Management Department

Power is always in great demand for industries and its quality always changes with different load. Hence there is a need of power quality check system.

The aim of this project is to build a simple, compact and energy-efficient system for measuring Active Power, Reactive Power & Power factor using a microcontroller based board. It is based on microcontroller along with a zero crossing detector circuit. Current transformer and voltage divider circuits are used for gathering real time current and voltage data. It is fed into the microcontroller via a zero crossing detector (ZCD) built using High Precision Operational Amplifier. ZCD converts current and voltage waveform to square wave. From the directly received phase data, microcontroller calculates the phase difference and hence the power factor of the system. Then from voltage, current and power factor the Active power and Reactive power can be calculated by the algorithm written on the microcontroller.

The measured and calculated value of Active power, Reactive power and Power factor are displayed on the LCD screen.

Keywords*:* Power Factor, Microcontroller, Zero Cross Detector (ZCD), Bridge Rectifier.

8. Development of an Assisted Audio Device for Braille Tutor

Vangala Bhavana (MIS: 121494008)

Guide: Prof. B. B. Ahuja, Department of Production Engineering and Industrial Management and Director,COEP

Less than 3% of the 145 million blind people living in developing countries are literate. This low literacy rate is partly due to the lack of trained teachers and the challenges associated with learning to write Braille on a traditional slate and stylus. These challenges include writing from right to left, writing mirror images of letters, and receiving significantly delayed feedback. And also the most demanded request was a device that works independently from a laptop. Since then, progress has been made with Standalone Automated Braille Tutors. The present technologies (such as Perkins smart Brailler) are either too expensive or suffer from other shortcomings such as the lack of interactive learning and no tactile output. So to make blind people understand Braille easily there is a need of an assisted device.

To fulfil this need an assistive audio device is proposed in this thesis which gives voice output immediately after typing the letter so that the blind person can understand whether the word or letter they have typed is correct or wrong. This will make them to learn Braille easily and quickly than the conventional methods. This is a cost effective and standalone, portable, light in weight device.

Keywords: Braille Tutor, Audio device, Blindness.

9. Design and Development of a Fire Fighting Robot

Apoorvakumar V. Bhavsar (MIS: 121494009)

Guide**:** Dr. Rajiv B., Department of Production Engineering & Industrial Management

Fire- fighting is an extremely dangerous task that has caused devastating losses because of lack in technological advancement. The current fire- fighting methods mostly employing humans are inadequate, inefficient and prone to errors. Using robots in fire-fighting is gradually gaining popularity. Robots fighting fire will help fire-fighters to concentrate on wide-spread fire than preventing potential fire ignition and explosion.

This project presents the design and development of a fire-fighting robot that navigates a fire hazardous given area, search for an outbreak of fire, move towards to search the exact source of fire, extinguish the fire and return back to continue patrolling the same area. Chapter 1 introduces the concept of Fire-fighting, problems encountered in Fire Fighting and the need felt for Design and Development of a Fire-fighting Robot. Chapter 2 discloses the work done till date on Fire-fighting robot and the objective of the project. Chapter 3 explains the design consideration used in developing Fire-fighting robot. Chapter 4 and 5 encloses the methodology used in developing the robot. Chapter 7 and 8 gives the results of the project.

Keywords*:* Flame sensor, Line Tracking, Fire Extinguishing, Solenoid Actuator

10. Fuzzy logic controller for co-ordinated control of VGT-EGR system of diesel engine

Rohan Bingi (MIS: 121494010)

Guide: Prof. D. N. Malkhede, Mechanical Engineering Department

To lower emissions and to improve performance of diesel engines, systems like Variable Geometry Turbocharging (VGT) and Exhaust Gas Recirculation (EGR) are incorporated in it. To meet the legislatives lowered emission demands, precise control of these systems is necessary. The VGT and EGR system is strongly coupled in most of the engine operating regions as they are driven by the same exhaust gas which results in problems like loop interaction, sign reversal and non-minimum phase behavior making precise control difficult using a SISO controller. To mitigate the cross-coupling problem certain controllers use a static de-coupler, but this does not offer the benefits offered by a coordinated control. The MIMO controller implements coordinated control strategy which utilizes this coupled nature to achieve better a control. In this paper a fuzzy logic controller is proposed that implements a coordinated approach for controlling VGT and EGR. Unlike traditional controls regulating MAP and MAF, in this paper the normalized oxygen-fuel ratio λO and EGR fraction xegr are chosen as the performance variables as well as feedback variables as they are directly related with the emissions. The fuzzy controller implements different control relation between inputs λO and xegr and outputs uvgt and uegr depending upon the engine operating region. A Model-In-Loop (MIL) simulation is performed with the diesel engine model to verify the control strategy. The controller is then programmed on an ARM Cortex-M3 processor based Arduino DUE Board and validated using Hardware-In-Loop (HIL) simulator.

***Keywords**:* VGT, EGR, coordinated control, Fuzzy logic control, MIL, HIL.

11. Internet of Things Based ECG Measurement Setup

Riyanka Milind Bhagat **(**MIS**:** 121494011)

Guide**:** Dr. U.M. Chaskar, Department of Instrumentation and Control

Internet of Things (IoT) is transforming the way in which the real world objects are interacting with each other. The IoT concept can be applied to different areas like home automation, smart cities, smart manufacturing, automotives and many more. One of the areas focused in this paper is Healthcare. In healthcare domain, IoT concept can be used to monitor the vital signs of a patient at hospitals as well as at home. In this thesis, an ECG measurement setup based on Internet of Things and Arduino is presented that focuses on gathering the patient's ECG data (Electrocardiogram) and displays it on a graphic user interface (GUI). The GUI is built on Microsoft Visual Studio software. The ECG data is recorded for one+ minute and then it is transferred in real time to a user friendly cloud platform – Thingspeak. The data is also downloaded in MATLAB software to be accessed by medical personnel for analysis.

Keywords*:* Internet of things, ECG, healthcare, IoT

12. Development of micro controller based module for sensing multiple parameters

Swapnil Doiphode (MIS: 121494012)

Guide: Mr. J. S. Karajagikar, Department of Production Engineering & Industrial Management

The project is aimed at developing a multisensory module that combines three sensors viz. Resistance Temperature Detector, Thermocouple and Frequency Measurement Sensor. In the later stage, we have added four more sensors viz. Accelerometer, barometer, Gyrometer and Magnetometer which will act as an inertial measurement unit and altimeter. There are products available in the market with such specifications but high cost is the main concern. The concept is mainly aimed at integrating sensors in order to produce precise output and to make the module cost effective and compact.

The development and integration of sensors in this module will find applications mainly in the process industries, naval applications, on board diagnostics etc. The newly added sensors to the board i.e. Accelerometer, barometer, Gyrometer and Magnetometer will find applications in motion activated devices, free-fall detection, intelligent power saving for handheld devices, automated appliances and robotics, display orientation, gaming and virtual reality input devices, motion control and IMU inertial measurement unit & AHRS etc.

The device can be specifically implemented in Drones or flights for flight stabilization control and to measure the height of the flight. I2C (Inter-Integrated Circuit) bus is used for the fast operation of the device as which uses only two wire lines and supports multi master configuration. Also major significance of I2C serial bus is that, it makes it simple to integrate multiple sensors in the same system.

The module combines a tri-axial accelerometer, Digital barometer, Gyrometer and tri-axial magnetometer which are manufactured using specialized micromachining (MEMS) processes with a separate CMOS chip that provides the interfaces between the modules and the host system. This design approach provides a dedicated interface circuit that is trimmed to better match the sensing element characteristics.

In this case, the pressure sensor would be used to measure a relative change in pressure over a short period of time to indicate a change in altitude, thereby fully positioning the handheld device in three-dimensional space.

***Keywords*:** Multisensory module, Micro-controller, Sensor IC's, RTD, T/C, Frequency.

13. Smart Trolley

Amol Ganeshrao Navpute (MIS: 121494013)

Guide: Dr. M. S. Sutaone, Electronics and Telecommunication Dept.

Now a day's Human-Machine interaction has reached a new level. Artificial Intelligence is embedded into Robots to achieve greater level of automation. The robot which is proposed here is an automatically driven supermarket trolley which will be following the customer. This technology would lead to comfort improvement since customers wouldn't need to carry a heavy bag and it will also allow them to walk freely. The robot is even more useful for old people and disabled with reduced physical abilities. The robot stays behind the customer at a short distance such that he/she is able to put articles in the trolley standing by. The automated trolley proposed here should then be able to detect the relative position of the target customer in order to follow him and maintain a safe distance. Also the robot should be able to detect any obstacle like other customer or racks to avoid any kind of collision with an object, a human or another robot to insure safety.

***Keywords**:* Indoor Positioning, Accelerometer, PDR, Obstacle Detection, Collision Avoidance, Bluetooth, Android

14. Design and development of toe hook bracket for recovery load criteria and driver drowsiness detection using Image processing

Prasad Tirodkar (MIS: 121494014)

Guide: Mr. M. N. Shaikh, Department of Production Engineering & Industrial Management

The objective of this master's thesis is to investigate how and when structural optimization should be applied in the design process. The used tools are Hypermesh, Optistruct and Hyper View which are parts of the software suite Hyperworks from Altair Engineering. Experience and knowledge in using structural optimization have been obtained by an initial literature study combined with evaluation of multiple trial cases of different parameter. The most common task has been to meet the recovery load criteria & mechanical properties as a constraint. This has been used to develop a sensible methodology together with guidelines for practical matters such as parameter values and recommended options.

Applying topology optimization in the concept level design stage a close cooperation between the designer and the analysis engineer to create the design which results reduced in the 50% design development cost. Further a proper assumption of loads and boundary conditions to get feasible solution. Interpreting the results from the topology optimization & implemented in final design will reduce 40% mass from the previous design and ultimately the cost of manufacturing.

The various ways through which drowsiness has been detected & best possible method with eye PERCLOS method with better accuracy is selected for the prototype build. Image synthesis based driver drowsiness detection system is observed to be 80% accuracy at the same time it is non-intrusive method with ease to use.

15. Automated storage and retrieval system for milk diary

Shraddha Kaldhone (MIS: 121494015)

Guide: Dr. (Mrs) A. V. Mulay, Department of Production Engineering & Industrial Management

Automated storage and Retrieval Systems (ASRS) are warehousing systems that are used for the storage and retrieval of products in both distribution and production environments. The majority of the reviewed models and solution methods are applicable to static scheduling and design problems only. Requirements of ASRS are, however, increasingly of a more dynamic nature for which new models will need to be developed to overcome large computation times and finite planning horizons, and to improve system performance. The three main components of this system are S/R machine, storage racks and system controller. SRM i.e. storage retrieval machine is the basic element of the system. It is made to function accurately and safely at higher speeds, operating in aisles only inches wider than the load it carries. The modern S/R machine runs on a floor mounted rail, guided at the top. Storage racks are next important components. In ASRS, material is stored in racks which differ from conventional racking. These storage racks are normally much higher and interface directly with the S/R machines and the guide rails. The system controller is built around a micro computer with proper interfacing hardware to communicate with the PLC and the Barcode readers. The software is capable of controlling the crane movements by giving appropriate commands to the PLC. It also has the inventory package running for on-line real time stock keeping.

The system development includes designing of the control of the control panels to control the operation of system like in-feed conveyors, Out-feed conveyors and many other operations. The positioning of the pallets will be controlled by PLC programming and the Warehouse management system. Tracking and identification system is needed for recognition of the pallet and proper flow of the pallet on the conveyors since it is a multiple input system. Bar-coding system will be used for this purpose.

16. Real time filed trainer for Pneumatic, Electro-pneumatic and PLC based Pneumatic applications

Purohit Aditya Balmukund (MIS: 121494016)

Guide**:** Dr. S.M. Patil, Department Of Production Engineering and Industrial Management

Mostly all industries around the globe use pneumatics, electro-pneumatics and PLC (Programmable Logic Controller) based pneumatic automation to carry out different processes. These processes may range from simple object clamping to complex plant setups that carry out sequential automated operations such as clamping , riveting, milling , drilling , embossing , shearing and many more all in same plant and operating sequentially. So we get an idea that all industries ranging from simple packaging industry to complex automobile and space-shuttle building industry use pneumatics, electro-pneumatics that are automated to carry out these processes. So it is very much of importance for the engineering students to get idea of how these systems are designed and how do they operate. These processes however cannot be shown to the students as it can be hazardous to observe these events that actually take place in industry. Also the cost of building these setups is very high. Many modular setups are available in market but these setups do not provide the real time feel of the industrial processes and also they do not provide all pneumatics, electro-pneumatics and PLC based pneumatic applications in same trainer kit. Moreover these modular trainer kits only show logical approach to the experiments. These kits available have constraint over the number of experimental logics that can be simulated. So here is an approach to develop a universal trainer so that the students can get a fair and detailed experience of pneumatics, electro-pneumatics and PLC based pneumatic applications. The motive is to design and develop a universal trainer that can give the students the knowledge of how these systems are designed, developed and operated.

Keywords: Pneumatic, Electro-pneumatic, Field trainer, PLC

17. Floor Mopping Robot

Sayali Prithviraj Chavan(MIS: 121494017)

Guide: Mr. M. R. Dhanvijay, Department of Production Engineering and Industrial Management

The floor mopping robot is a fast developing application in service robot industry. There have been many researches on working and control of the cleaning robot, though very few refer to the technique of mopping in particular. However these researches prove the practicability of the concept. This project proposes a model of floor mopping robot in particular at an optimum cost and highest possible mechanical efficiency and also a new low cost algorithm for area filling. The motion of robot is controlled by using two wheels coupled with motors which are controlled using Arduino board. Ultrasonic proximity sensors are used for obstacle detection. The task of area filling is carried out using the data from ultrasonic sensors and an android application for remote control of robot. The cost of robot is significantly reduced to the one third of currently available robots in market. The robot is able to climb slope upto 9 degrees. The speed of robot is 0.21m/s.

Keywords*:* Mopping robot, Area filling techniques, obstacle avoidance

18. Internet of Things based digital energy meter

Sonal Shankar Kadu(MIS: 121494018)

Guide: Dr. U.M. Chaskar, Department of Instrumentation & Control Engineering

Home automation is fast popularity nowadays. An automatic remote meter-reading system based on wired communication is presented in this paper can be considered as a part of home automation. The Energy data collection system is a very important step and part in the research of energy visualization and analysis. Through this system, Electricity Board (EB) officer can easily know electricity usage of every house at any instance. Wired communication based smart energy meter system is presented in this paper is in terms of reduces errors, absence of consumer while taking reading etc. There are many possibilities to collection of energy data. The main aim of the project is to develop remote energy measurement system using RS485 communication protocol and send the data of digital energy meter onto the cloud by using IoT concepts. Sensor (digital energy meter) data is send over RS485 communication protocol to the Local Server of MSEB office. The data is total energy consumption and the data shows total power consumed. The Local Server collects the energy data, stores it in database and the stored data is send on to cloud by using IoT concepts. The send data can be seen from anywhere, at any time by anyone (authorized people only) from any place. Using this data the bills of every customer are generated automatically at the start of every month and the detail of a bill is send on to the mobile of every customer. The send data from digital energy meter to Local Server will be safe as wired communication is safer than wireless communication. Also the data send from Local Server on to the cloud will be safe as access of data will be given to only authorize people.

***Keywords*:** IoT, Cloud platform, Digital Energy Meter, RS485 to USB converter, Security, Billing automation, Web Portal.

S. Y. M. Tech [Mechatronics] 2014-15

Dissertation Phase - II Abstracts

1. Automated Modular Liquid Color Filling Plant

i) Bansode Sumit Rajkumar (121394002)

and

ii) Gangadhare Aditya Chandrakant (121394006)

Guide: Dr. S. M. Patil, Dept. of Production Engineering and Industrial Management

There are numerous advancements in the field of bottle filling which ranges from cosmetics to industrial adhesives. Complete bottling plants are available which includes processes right from part feeding to escapement and placing. Highly accurate and precise actuators and sensors are being developed to enhance the productivity of the plant. Generally these plants are having high capacity. However these systems are costly and are not modular hence cannot be used for demonstration purpose. The project mainly focuses on developing a complete modular bottle filling system which can be used to demonstrate the working of various components of an automated plant in institution laboratories.

An “Automated modular liquid colour filling plant” comprises of modules such as Bottle supply (conveyor), Colour filling, Cap feeding and tightening, Escapement and placement device (A jointed arm robot).Bottle supply module is a belt conveyor driven by a dc motor and controlled by an intelligent microcontroller based algorithm which saves up to 47% of power. Filling module can fill three different colours into the bottles and the selection of output colour is done by a changer mechanism. Here time gravity filling strategy is used and level sensors are used to minimize the error in the output product volume. Feed track is connected to place a cap onto the filled bottles which is succeeded by a tightening module to tighten a threaded cap. Bottle is escaped by a guided ramp and is further handled by a 3 axis jointed arm robot which places the bottles in the box. The bottle is indexed at each station with the help of a circular slotted plate driven by a stepper motor. To input the desired number of bottles of each colour, there is a User interface which includes a liquid crystal display, a matrix keypad and the process indicators. The supply of empty bottles and their caps is not considered within the scope of automation and hence they are needed to be fed manually.

2. Poka-Yoke Autochecking System for B-Pillar Assembly Component.

Bhamare Prashant Vijay (MIS No. 121394004)

and

Dr. Rajiv B. Dept. of Production Engineering and Industrial Management

Poka-yoke is a Japanese improvement strategy for mistake-proofing to prevent defects (or Nonconformities) arising during production processes. Poka-Yoke is a preventive action that focuses on identifying and eliminating the special causes of variation in production processes, which inevitably lead to product nonconformities or defects. This project presents an approach for an automated assembly checking system of B-Pillar lower component, whether the assembled object are present in the given place or not. The system provides a fast inspection of objects and makes a necessary programmable decision. According to the inspection result of the entire assembled object the respective indicator of that object will response. If there is absence of any object then respective object bulb will not be glow and after the 5 sec Buzzer will start. As per the Indication of Buzzer the worker comes to know that assembled components are either missing or misplaced. There are total six no of assembly component and for detection of that Component six no of fork type photoelectric switches are used. One diffuse type photoelectric sensor is used for presence of B-pillar component on the Poka-Yoke. The necessary programmable action is taken form PLC (Programmable logic Controller).

3. Design and Development of Android Application for MultiPara Module

Deepak Kumar Singh (MIS No. 121394005)

and

Dr. U. M. Chaskar, Dept. of Instrumentation Engineering and Control

Diseases are the most common cause of death in many countries. However, a MultiPara, which allows monitoring the various parameters, is quite expensive. As a result, only a few ambulance vehicles are equipped with those devices. Therefore we want develop a rather cheap and mobile MultiPara. To minimize the cost we replaced conventional monitors by existing devices like smart phones. The main parts of our project are four modules (ECG, SPO2, NIBP, Temperature) each having a microcontroller, a master microcontroller, Bluetooth module, Android App. This electrical component sends the data measured by the microcontroller to an Android device. Our Android application, which is executed by a Smartphone or tablet, converts the received data to screen information and displays the heart curves, Oxygen saturation, Blood pressure, Temperature on the device's screen. Since we use an Android device, we are also going to provide additional features. So we implemented a function allowing the users to record their heart curves as raw stream as well as screenshot. This recorded data can be stored and can be visualized offline. Furthermore the recorded data can also be sent by E-mail which is a facility internally provided in application. This function allows home users to send a MultiPara screenshots to a doctor who is able to analyze it. We are also providing options like auto connect with last device, screen capture and a complete control of MultiPara. Moreover we are going to provide an emergency call function which is especially useful for people who are in a critical condition. The number which should be dialled can be configured in the application's settings. It also include help guide to make our app user friendly.

4. Automated inspection of Defects in Glass Using Digital Image Processing

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and

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Defects in glass which show poor quality are the major problem for manufacturer in glass making industry. It is very difficult and prone to error process to manually inspect very large size glass. The manual examination process is slow, time consuming and prone to human error. The glass defect detection technique using image processing provide much relief from error, to manufacturer and also provide strength to hold in market providing best quality and low cost glass to customers.

Digital Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. Using image processing concepts like image enhancement, image conversion into various color spaces, image segmentation etc., will detect the various defects in Glass.

In this project, an evaluation system for detection of various glass defects like scratches, inclusions, surface defects, bubbles etc. is developed. The process involves ‘Color space selection and two different segmentation technique namely Discrete Wavelet Transform (DWT) and Fast Fourier Transform(FFT)’ has been tested for detection of various defects in glass. Finally both segmentation method is compared for each image to give the best possible result.

5. Design and Development of Hybrid Gripper System

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and

Dr. M. D. Jaybhaye, Dept. of Production Engineering and Industrial Management

Industrial robots are very popular in now day's automation factories, industrial robots can perform jobs that people are not willing or able to perform. Industrial robots can repeat the same works at the exactly same way, resulting a higher quality of production. Industrial robots can work in several areas, each robot must have a specific tool for each area. For specific task such as loading, handling, drilling, painting, etc special end effector is design according to function. End effector is disposed in the end of manipulator. End effectors do physical contact with target materials for doing assigned and required task.

In material handling process mechanical gripper like three finger gripper or five finger gripper cannot be easily implemented. Vacuum and magnetic grippers can be designed to handle sheets and plates. The gripper system is designed which can handle both ferrous material as well as non-ferrous material. Such gripper system is termed as hybrid gripper system. Hybrid gripper is designed to handle both the soft material and solid material. In pick and place task, it is better to do suction than grip. So hybrid gripper system is designed with one vacuum gripper and one electromagnetic gripper. Ferrous metal detector detects the type of material whether ferrous or non-ferrous and accordingly signal is given to actuate gripper.

Vacuum generator is used for vacuum generation. Approximately 70% vacuum is produced by vacuum generator with 6 bar compressed air supply. The optimal design of an electromagnet tip, to enable robust pick and place activity by an industrial robot is done. Payload capacity of gripper system is 3kg. Hybrid gripper system is tested for conveyor loading and unloading operation.

6. Design and Development of Automated PCB Drilling Machine

Survayanshi Preetam (MIS No. 121394010)

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Dr. M. D. Jaybhaye, Dept. of Production Engineering and Industrial Management

The development of all Electronic Control Units usually extensively uses PCB or Printed Circuit Board**.** Making a PCB is an involving process that those who are involved in electronic circuit manufacture have to go through. Not least among its many tasks is the act of drilling the PCB holes whether for vias and pads, which needs both precision and patience. Often, the repetitiveness of the task can lead to countless frustrations among the labourers particularly the beginners. The manual PCB drilling process also suffers from major setbacks like –

1) Drilling a large no of holes make the process tedious.
2) Decreases the productivity.
3) The efficiency is also low, and
4) Not cost and time efficient.

Therefore this project is an attempt to develop a prototype solution aimed towards large scale manufacturing of printed circuit boards .The project focuses on the design approach and methodology for the process which is divided into three steps:

(i) The Mechanical actuation units and their distribution,
(ii) The Electronic Control Unit or The Microcontroller architecture design and
(iii) The Software development of the System.

The Mechanical actuation units comprises of 2 lead screw mechanisms at the base forming the X-Y movement and 3rd Lead screw mechanism acting as the Z axis . The coordinate position at (X,Y) on the PCB is attained by 2 stepper motors at the base of the setup and the third stepper motor at the top actuates to lower the drill head and drill at the desired location on the PCB The signalling is done by an Atmega 328P microcontroller to control the 3 stepper motors and the DC drill motor with appropriate control algorithm , requiring the user to only feed the desired drill file in the appropriate format.

7. Development of surface roughness measurement system using image processing techniques

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and

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Surface roughness measurement is essentially required to assess quality of machined object. Different types of methods are used for measurement. Conventionally the surface roughness measurement is done with a stylus instrument. Stylus profilometer causes scratches on soft material surfaces during the measurement process; it results in degradation of surface quality. Also it is not suitable in high-speed. Non-contact methods are highly recommended, as these methods are non-destructive, fast and reliable. Non contact type methods generally involve vision system and image processing techniques. Light sectioning vision system is best example for these techniques. The light section is projected on surface of work piece. Microscope and light source is arranged in a specific manner, as each of them is inclined at an angle of 45o to the normal plane. The reflected light is can be observed using microscope. The camera is connected with microscope to capture the images. These images are analysed and processed using image processing software. The images captured by camera are generally colored images. These images are converted in binary or black and white images to perform the roughness measurement calculations. These images are further converted into point cloud data. We can calculate the required surface roughness parameters by using this point cloud data.

8. Design and Development of Car Simulator using Dassault Systems tools

Khakal Amit Bhausaheb (MIS: 121394012)

and

Mr. M. R. Dhanvijay, Dept. of Production Engineering and Industrial Management

The main objective of this project is to design and develop the driving auto simulator using Dassault System tools, which mainly has the moving platform as its motion device, steering wheel, acceleration and braking pedals as its input device, and computer graphical system as its visual component. The main task is to move the platform relative to the input given by the driver with help of steering and pedals. The platform should also respond to the road graphics running on the computer which is interfaced with the total system.

The tools which are used to design and simulate the project are the tools which are provided by the Dassualt systems. Catia is the main tool that is used in the project. Under this brand there are two sub-tools DBM(Dynamic Behavoiral Modeling) and Control Build which we are using for design, simulation, and validation of design. 3DVIA studio is another tool under the same brand which used to design the graphical system. This is used to create different driving environments so that behavior of the system in different environments can be tested. While following the driver's steering signal and matching the platform's motion, the visual system creates animation scenes of the environment which are shown on the screen in front of the driver.

9. Electronic condition based predictive maintenance onboard naval ships

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Condition Based Predictive Maintenance (CBPM) is an effective and proven tool in predicting the performance of machinery. With advancement in technology the required impetus for implementation of the CBPM tools have become a cost effective and productive affair. A ship is equipped with state of the art machineries in a complex platform. The exploitation of these equipments are similar to that of a large scale factory. Moreover in a warship the number of equipment is thrice as that of a merchant ship to cater for redundancy. The exploitation pattern is also rugged due to variable speeds required to be achieved during a war patrol. It's the performance of these machineries that provides the required thrust to the propulsion of a ship. The technology advancement has helped in easy collective monitoring of all these equipment in a control room. However there is a lacuna in the maintenance of these costly state of the art machineries. Maintenance is an important aspect for an engineer ensuring timely availability of trouble free machinery for longer duration with minimal layoff period improves his efficiency.

It is proposed to streamline the maintenance activity onboard a Naval ship by developing suitable software to integrate the measurements undertaken on a mechanical component with electronic equipments. The maintenance of equipment fitted onboard hundreds of ship with each ship accounting for 200 machineries is a humongous task. It also amounts to huge amount of expenditure to the exchequer, extended layoff and elaborative trials. The aim of this project is to rely on CBPM tools, delay maintenance based on reports generated, reduce layoffs and implement integrated monitoring of all ships with click of a button.

The challenge lies in identifying ships with similar equipment, creating databases, utilization of CBPM tools and development of software to track the exploitation patterns of equipment. It necessitates identification of single major equipment onboard a Naval ship and continuous monitoring to study the exploitation pattern. This can be achieved by identifying cost effective CBPM tools and its utilization in monitoring the equipment over a period of time to device a maintenance schedule. A methodology can thus be developed which can be integrated with suitable software to monitor the numerous Naval ships.

The course of the project has given the need to develop a handy, simple and vibration meter to enable quick and easy monitoring of basic vibration of equipment. Thus a simple programmable vibration meter with overall vibration display and LED lights for alarm level indication has been developed.

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10. Self correcting action of Stewart platform for surveillance system irrespective of external disturbance

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Stewart platform is one of the upcoming concept. Its application in field of robotics and parallel manipulators is high. Stewart platform is famous due its synergetic motion and one of its application as discussed in this thesis is the self correcting action.

The technique of self correcting is applicable in surveillance systems of unmanned air vehicles (UAV) for proper images and videos of the region under survey. Given Project have the two platforms , top plate attached to the UAV(Unmanned air vehicles) on which forces will act , so that entire system moves but irrespective of external disturbance bottom plate having camera attached to it will remain horizontal so that surveillance will be proper.

The forces acting on it are generally aerodynamic forces which are unpredictable and it is unknown but here the output is fixed that due to Motor action the bottom plate is horizontal. This system has wide range of application especially in the traffic control, forest fires, any natural calamities etc.

11. Design and Development of Continuum Robot

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Recent work on soft technologies embodied in robotic systems has been greatly inspired by the study of soft-bodied animals. The investigation of biological examples is playing a vital role in developing new robotic mechanisms, actuation techniques, and algorithms. To construct robots that implement the biomechanical intelligence of soft-bodied animals, we need new active soft materials. Developing soft muscle-like actuation technology is still one of the major challenges in the creation of fully soft-bodied robots that can move, deform their body, and modulate body stiffness.

Mimicking some features of the octopus is instrumental to design a dexterous and compliant system. The modelling and control of such flexible arms are still challenging problems. The main objective of this research is to capture the key features of real octopus and somehow relate these features to the modelling and locomotion control for robotic system. Parallel actuation used mechanisms approach suited to the elephant trunk anatomy. Using a segmentation process, and by stacking these parallel mechanisms we obtain the single arm model. By combining all single arm models, one for each arm of the elephant trunk with a central body structure we got the multiple continuum arm system.

12. Design and development of car simulator using Dassault System tools

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Auto car simulator is the replica of the real car which is designed to get the feel of the real car. The objective of this project is to design and develop the driving auto simulator using Dassault System tools, which mainly has the moving platform as its motion device and steering wheel, acceleration and braking pedals as its input device, and computer graphical system as its visual component. The main task is to move the platform relative to the input given by the driver with help of steering and pedals. The platform should also respond to the road graphics running on the computer which is interfaced with the total system. The tools which are used to design and simulate the project are the tools which are provided by the Dassualt systems. Catia is the main tool that is used in the project. Under this brand there are two sub-tools Dymola and Control Build which we are using for design, simulation, and validation of design. 3DVIA studio is another tool under the same brand which used to design the graphical system. This is used to create different driving environments so that behavior of the system in different environments can be tested. While following the driver's steering signal and matching the platform's motion, the visual system creates animation scenes of the environment which are shown on the screen in front of the driver. This visuals on the screen contains road, buildings, footpaths, traffic signals, another cars, pedestrians, etc.

13. Development of nanapositioner for fibre based Fabry-Perot interferometer

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The objective of this project is “Development of Nano-Positioner for Fiber based Fabry-Perot Interferometer” which is used as a highly sensitive detection technique for AFM. The motivation behind this project is to the study the nature of protein unfolding by small amplitude Atomic Force Microscopy (AFM). In AFM a cantilever is deflect while scanning a sample surface due to the interaction force between tip of the cantilever and sample surface. In the dynamic technique of the conventional AFM, a cantilever is oscillating near resonance frequency where amplitude of oscillation is 1-10 nm. In small amplitude AFM, a cantilever is oscillating far below the resonance frequency where the amplitude of oscillation is 0.1-1 Å. As the amplitude of oscillation of the cantilever is already too small and while scanning the sample surface, its amplitude is affected by a small value. To detect this amplitude, a highly sensitive detection technique is required. In conventional AFM, a laser beam deflection technique is used to measure the cantilever deflection but, its deflection sensitivity is very low for measuring small amplitudes. It can be increased using another technique called Fiber interferometry which uses the formation of Fabry-Perot etalon between a fiber and the back of the cantilever leading to a very high sensitivity.

14. Design and development of computer controlled electromechanical mount for manoeuvring a telescope

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It is essential requirement in area of astronomical research to develop a machine (known as mount) with which it will be helpful to track and view astronomical objects. The purpose of this dissertation is to develop such a mount which will be of help amateur astronomy enthusiasts. It will help in manoeuvring a telescope and controlling it to point to the desired object in the sky. The control will be done from the software running on the computer connected to this mount. Computer software sends the slew commands (for movement) to the mount which will in turn manoeuvre the telescope using the electronic motors and mechanical assembly of the mount. The mount can be operated in two modes – Normal and Scanning. In normal mode, the mount will simply move the telescope according to the arrow keys (up/down/left/right) selected on the software. In scanning mode, the telescope will perform a line by line scan of the area of the sky selected in software.

Paper published : ***Design and development of computer controlled electromechanical mount for manoeuvring a telescope***

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15. Automated medication dispensing system

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It is necessary to provide medication to the aged in time. Automatic medication dispenser is designed specifically for users who take medications without close professional supervision. It relieves the user of the error-prone tasks of administering wrong medicine at wrong time.

A device for dispensing pills one at a time or one dose at a time consists plate mechanism for dispensing disk shaped tablet and cone mechanism for dispensing either capsule or caplet. The major components of this medication dispenser are Arduino interfaced with a Motor Controller, an Alarm system. The overall operation is to facilitate the user to set the timings to dispense pill at required timings. The Alarm system is designed to provide indication a beep sound for user. The user is required to press a button to get the pill.

Here User interfacing is done by Arduino Uno and Arduino Uno is act as Main Controller Board. Arduino Uno is interfaced with Stepper motor which is used in plate mechanism, two servomotors used in cone mechanism, and few electronic components like RTC, buzzer, micro switch.

The major objective is to keep the device simple and cost efficient. The software used is reliable and stable. Elderly population can benefit from this device as it avoids expensive in-home medical care.

The Automatic Medicine Dispenser is working for disk shaped pill (tablet) and capsules or caplets of any size. It has been found that the dispenser can be programmed for 7 days for different size medicines. It has the facility to send alarms four times a day.