

**School of Mechanical & Manufacturing Engineering (SMME), NUST**

**Technologies Developed**  
**Engine Blow by Monitoring System**

PI: Dr. Riaz Ahmad Mufti

Summary:

Blow-by occurs when the explosion that occurs in your engine's combustion chamber causes fuel, air and moisture to be forced past the rings into the crankcase. Piston rings must maintain an excellent fit in order to contain the pressure. As rings and cylinder liners wear away they are less capable of maintaining this seal. Consequently as an engine ages the amount of blow-by that occurs can increase. Soot and deposits left over from incomplete combustion that collect on the rings can also inhibit their seal worsening blow-by.

One of the most challenging parameters to measure accurately in engine testing is engine blow-by. Even the blow-by flow rate of relatively large engines is low and thus is difficult to measure through conventional means. Special techniques are used to measure such limited flow rates, keeping in mind that the back pressure should not be generated during measurement as this will directly affect the engine performance and measurement.

NUST-School of Mechanical and Manufacturing Engineering took this initiative to develop engine health monitoring system and after eight months of design development and testing, the school Automotive Technology Research Group developed the Blow-by monitoring system for our local industry. Two versions have been developed. The RAM BB-1 can be connected to any computer/laptop through usb connection whereas the RAM BB-2 comes with a touch screen especially design for field applications.



Engine Blow By Monitoring System

## Design and Development of Engine Test Cell for Green Engine

PI: Dr. Riaz Ahmad Mufti

### Summary:

Pakistan's first engine test cell was designed and developed at the client's premises using state of the art technology. The engine test cell comprises of drive-by wire mechanism. Eddy current dynamometer. Throttle control mechanism, of same spec used for testing F1 engines. Pneumatic control engine start/stop mechanism. Fuel conditioning unit, suitable for Euro testing. Dual flow control cell ventilation system capable of generating both positive and negative pressures. System also includes electrical actuated damping system. Water cooling system for the engine and dynamometer. A range of sensors for monitoring complete engine performance. Multi-screen computing system for the control and monitoring of the complete test cell and engine. It is a complete centrally controlled system. State of the art emission analyzer coupled with the test cell control system. The system is controlled through modular based advanced data acquisition system. Wide range of tests can be conducted in the test cell including Durability test, fuel and lubricant consumption test, engine friction test, Emission tests including 4-8mode test, etc. Also a range of drive cycles can be simulated in this test cell.



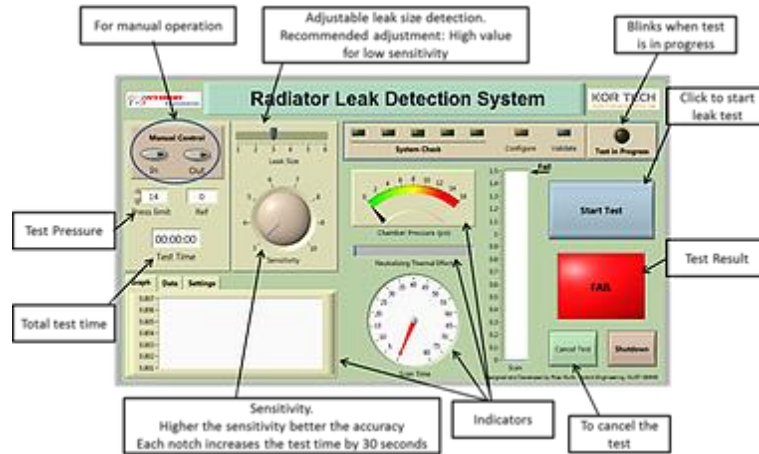
Green Engine Test Cell at Millat Tractors Limited

## Radiator Dry leak Detection System

PI: Dr. Riaz Ahmad Mufti

Summary:

Leak Detection System for Radiators was especially designed and developed for Radiator Manufacturers. This system is adopted to replace the conventional wet testing where the radiator is pressurized and dipped in water tank for visual detection of leak. The drawback of such method is the water scale marks left on the product after the completion of the leak test. One of the main advantage of using our system for leak detection is that the product is shipped in mint condition with no scale marks on the product.



## Production Optimization Project at Starco Fans (A product of U.I Industries)

PI: Dr Shahid Ikramullah Butt

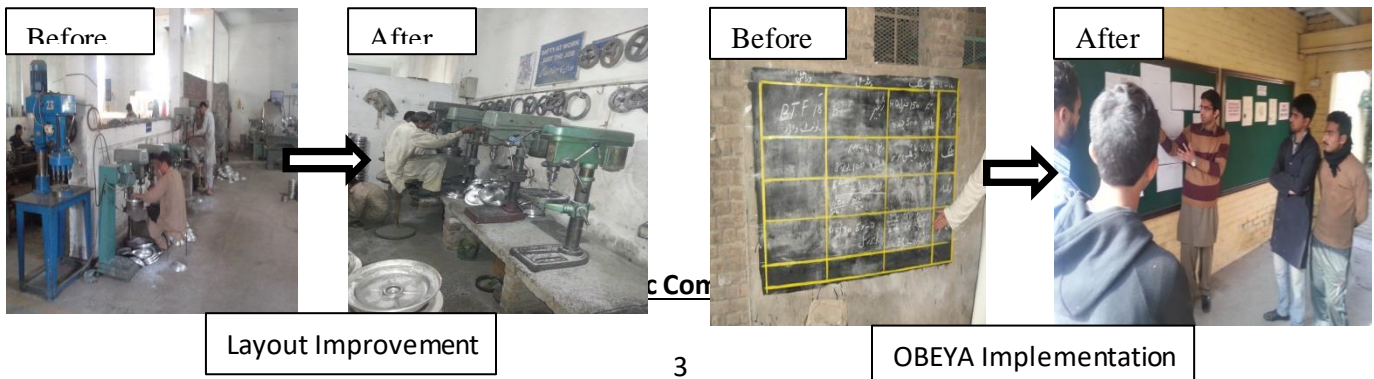
Co PI: AP Nabeel Younus

Summary:

The production optimization project aims at reduction in wastes through application of customized Lean production tools and techniques. The result for the industry was an improved facility layout and capacity to enhance production levels through planning and management tools.

The Shop Floor Production Optimization project was completed after focusing on four major areas:

- a. OBEYA
- b. Value Stream Mapping
- c. Production Simulation
- d. Layout Improvement



### **Auxiliary Power Unit**

PI: Engineer Naweed Hassan

Summary:

Recently SMME has developed an Auxiliary Power Unit (APU) through integration of a Diesel Engine with an Alternator. The project has been completed successfully at prototype stage and is under evaluation.



### **Fume Hood**

PI: Engineer Naweed Hassan

Summary:

Fume Hood has been manufactured with customized design in DMRC (SMME) for SNS (NUST). 2x Fume Hoods are completed and handed over to concerned School/Department.



### **Hydraulic Flume**

PI: Dr Liaqat Ali

Summary:

MRC, SMME has recently developed a Hydraulic Flume Apparatus for Abasyn University, Peshawar on demand. Flume is undergraduate laboratory equipment which is to be used in Hydraulic Laboratory.



### **Artificial Knee Joint**

PI: Dr Liaqat Ali

Summary:

Design and development of artificial knee joint from alternative materials (Aluminum alloy) instead of titanium being an expensive material. External knee joint was fabricated indigenously to overcome the higher cost of imported product. This will help to bring disabled persons due to calamities into normal life.



### **Smart Coronary Heart Diseases**

PI: Dr. Murtaza Najabat Ali

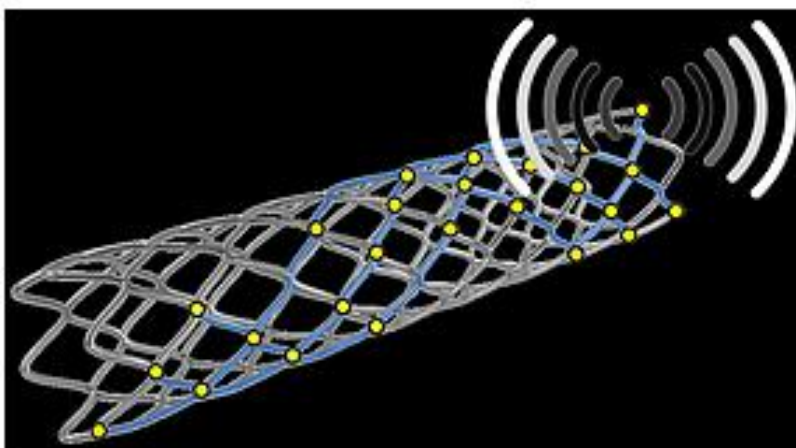
Summary:

The prevalence of Coronary Heart Disease in Pakistan is high; consequently a large amount of the population cannot afford to go for angioplasty or cardiac stent implantation, which is the standard treatment for

blocked arteries in the treatment of this pathology. In an advanced study of intelligent medical devices we can explore the possibility of developing a coronary artery endo-prosthesis with a novel design, for treatment and monitoring of coronary heart disease. The proposed stent system is going to be integrated with a smart displacement sensor; this diagnostic tool will be consolidated with a Radio Frequency (RF) component. The resulting product will combine the advantages of a Coronary Stent system, along with non-invasive monitoring capabilities. The stage and progression of disease as well as any changing in-vivo conditions may be monitored by an external RF component, which can provide clinicians with real time patient alerts. In case of ambulatory patients who are not hospitalized, the ex-vivo (or active component) of the RF device can prompt the patient about their hospital visits, based on any changes in the internal pathology sensed by the in-vivo passive RF component. Along with the modification of the treatment plan without the need of expensive or invasive diagnostic procedures, this novel stent can act as a real-time monitoring system and help enormously in preventing problems caused by delay in diagnosis or treatment.



Bare Metal Stent System



Real Time Monitoring of Physiological Parameters

## Establishment of Medical Devices Development Center (MDDC) at NUST

PI: Dr. Murtaza Najabat Ali

### Summary:

Ministry of Science and Technology (MoST) has sponsored NUST for the establishment of manufacturing facility for both BMS and angioplasty balloon catheter through different PC-1(s). A purpose-built "*Medical Devices Development Center* will have production facility of BMS and DES (DES has larger market share than BMS and is more costly);

The objectives are to produce Bare Metal Stent System (BMS) and Drug Eluting Stents Systems (DES) at a lower cost for the hospitals in Pakistan which covers a larger market share and is more costly or almost inaccessible for the poor people of Pakistan. The center will ensure availability of BMS and DES to the poor and save foreign exchange being spent every year on imported stents.

- The impact of developing a purpose-built Medical Device Development Center would be that we can effectively house BMS and DES production lines which can conform to the regulatory requirements of DRAP and MHRA (UK).
- There is an enormous quantitative financial impact through indigenization of biomedical devices which are frequently used for the treatment of general public of Pakistan. We have signed a Memorandum of Understanding (MoU) with cardiac hospitals including AFIC and RIC relating to their bilateral rations regarding R&D activities and development of indigenous cardiovascular devices where Cardiologists will provide extensive clinical support and clinical guidance to us.

They can also use the indigenously developed cardiac stents in their own facility and encourage other cardiovascular clinical setups within the country to use this medical device for the treatment of coronary heart disease.



MDDC Building



*Clean Room Facility for Stent System Packaging and Testing*





MDDC Product: Bare Metal Stent



MDDC Product: Drug Eluting Stent



MDDC Product: Angioplasty Balloon Catheter