

FROM THE EDITOR'S DESK:

We are proud to release our second issue of SMARTIN magazine after our earnest efforts to bring such a technical handout. Our prolonged dream came true by publishing this ready reckoner for fresher and future planners. Hope this magazine will be liked by all our college mates, moreover, our recruiters too. Kind remembrance to all those who contributed every little for our efforts. The first issue was released as hard copy, however, the second issue of our magazine for the year 2013 is being released as e-magazine in our MCET website.

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SMART IN ACTION

a. NON CONTACT HEART- RATE MONITOR USING UWB RADAR

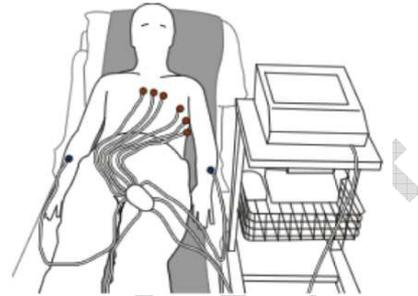
The type of measurement of ECG is normally with conventional “fixed-on-body” electrodes. They are inconvenient and inadequate for long-term, everyday measurements. There is also possibility for skin irritation effect due to prolonged use of skin ECG electrodes. There is a possibility to perform heart monitoring without physical contact with the patient using Ultra-wideband (UWB) radar. This helps in monitoring of human cardiac activity without contact in many places.

Discomforts:

The heart rate is considered as primary vital sign information which is needed from a patient in both emergency and clinical situations. Conventional “fixed-on-body” electrodes such as Ag–AgCl electrodes are used. Fixed-on-body electrodes are reliable and give good signal quality. But the presence of cables can considerably limit the patient mobility and comfort, forcing him to maintain the initial position (supine) for all the monitoring period of time or limiting his/her movements because of the cables length.

There is the possibility to perform heart monitoring without physical contact with the patient. Non-contact detection and monitoring of human cardiac activity without contact through bedding and clothing is a valuable tool in intensive care monitoring, long term-monitoring

and home health care applications as well as in other non-clinical fields such as the case of workers health monitoring (i.e. airplane pilots, fire-fighters, etc.).



ECG electrodes placement



Skin Irritation

Non-contact methods:

The non-contact methods for heart monitoring have been divided in three categories, based on the working principle:

- Electromagnetic-based monitoring systems
- Laser-based monitoring systems
- Image-based monitoring systems

The common characteristic for all the methods is to measure the surface (skin) displacement taking place because of the heart muscles contractions (change in the volume of the heart). Specific studies carried out with

optical methods report that the maximum displacement takes place in correspondence of the heart apex and it is reported to be in the order of about 600 μm . Even though Laser-based monitoring systems, Image-based monitoring systems are non-contact methods, it has disadvantages like irritation. Well trained technicians are needed and these methods are not user friendly. So, the method on electromagnetic monitoring systems is used. UWB radar is proposed for non-contact HR measurement.

Ultra-wideband:

Ultra-wideband (UWB) radar is an emerging technology with some unique attractive features which are combined with researches in medical engineering fields. UWB radar is non-invasive, low power, and can be manufactured in a small, portable form factor. UWB tracks cardiac and respiratory motions remotely, without direct skin contact.

The UWB radar has several key advantages such as:

1. The pulse has a wide frequency spectrum that can easily cross obstacles.
2. The pulse length is very short but has a very elevated resolution.
3. The short pulse leads to a little energy consumption.
4. It has a good resistance to the multi-path interference.
5. It allows not only the detection of a human being, but also its positioning.

6. Low electromagnetic radiation
7. Non-invasive, non-contact, and non-ionizing.
8. High precision ranging at the centimetre level.

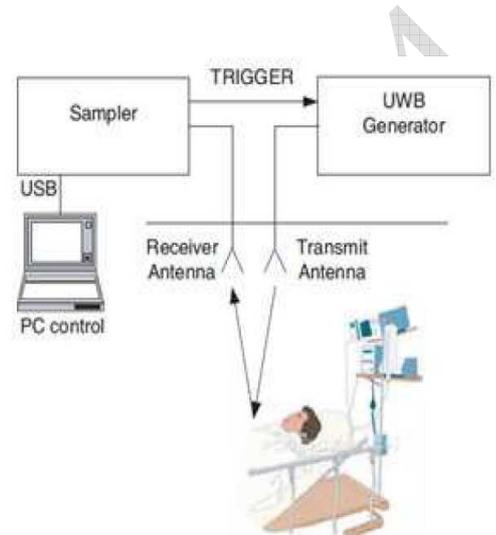


Figure1: Block Diagram

Working:

The wide band pulsed radar (UWB) is the electromagnetic system used for monitoring the heart function. The commercial usage of the bandwidth will vary in different countries and it is defined by FCC. The power radiation requirement of UWB is strict and it usually it

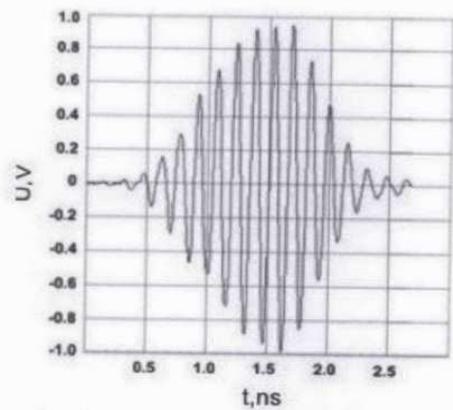


Figure2: Radar Signal

does not disturb the other equipment because UWB's spectrum is normally very low.

The basic principle of radar is to transmit a microwave (radio) signal towards a target. Pulse radars make use of a pulse generator to allow the EM pulse transmission from the antenna and simultaneously activate a delay line used for controlling the sampling of the received echoes. Time duration between emitted and received echo is proportional to the target distance. The receiver can be activated at very short time, triggered by the delay-line (range gating). Thus, the length of the delay-line ensures that only pulses back-scattered from a certain distance are received. Reflected signal from the target, will be received by the antenna and sampled by the sampler. The strength of the sampled signal is measured. Emitted pulses are spread over a wide frequency spectrum having very short time duration (in the order of ns or sub-nano seconds of duration).

The main advantage of such type of radar is the low energy consumption due to the short pulses.

Conclusion:

Ultra wideband radar is a flexible technology that can be adapted to a variety of medical applications. By using the radar principle, heart rate is calculated. This method will eliminate the wires to obtain the heart rate and respiration of patients in ICU room. It can be also used for home health care applications. They are low-power, safe, portable, and inexpensive.

b. ACCIDENT PREVENTION USING BLUETOOTH

Introduction:

Bluetooth devices are capable of communicating with eight other devices simultaneously. We can monitor and check the speeds of eight neighbouring cars simultaneously, thus preventing accidents. Thus if we have two Bluetooth enabled devices in two cars, the devices automatically communicate with each other when they come in the range of up to 100 meters. The range is dependent on the power class of the product. Power transmission rates vary in many Bluetooth devices depending upon the power saving features available in a particular unit, bandwidth requirements, transmission distance. The statistics of road accidents is tremendous and highlights the need for such a system.

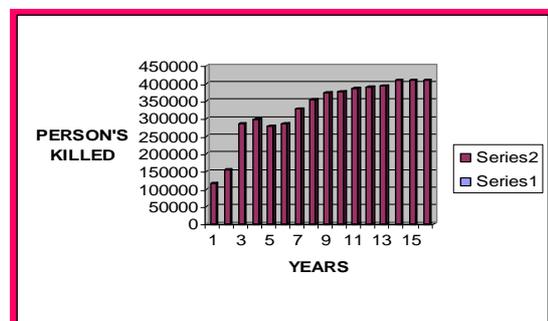


Figure3: Statistics of road accidents

The Bluetooth radio is a short distance, low power radio operating in the unlicensed spectrum of 2.4 GHz and using a nominal antenna power of 20 dB. The modulation used in Bluetooth is Gaussian frequency shift keying, in which zeros are represented by low frequency and ones are represented by high frequency.

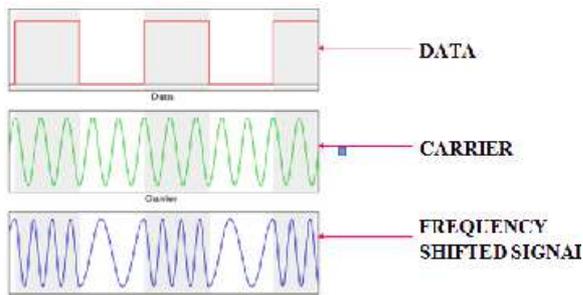
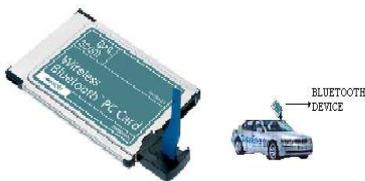


Figure4: Gaussian frequency shift keying

Radio communication is subjected to noise and interference, as the 2.4 GHz frequency is shared between the all devices in piconet. The Bluetooth specification has solved this problem by employing what is called as spectrum spreading, in which the Bluetooth radio hops among different frequencies very quickly. There are 79 hops starting at 2.402 GHz and stopping at 2.480 GHz, each of which is displaced by 1 MHz the Bluetooth avoids interference by hopping around these 79 frequencies 1600 times per second. So in order to avoid it we use Bluetooth equipped car, in which each car have Bluetooth transmitter and receiver. And every car should have minicomputer to monitor the relative position of the car with the other car.



Pc card is receiving the signal

At the 10 dB level, the range is 100 meters, meaning the equipment must be within 100 meters to each other (about 328 feet) to communicate using the Bluetooth standard. With the help of this technology, we can send data to

seven devices (cars). The group of eight devices is known as Piconet. Our car will monitor seven other cars which are closest to us. Based on the distance the tabulation is plotted.

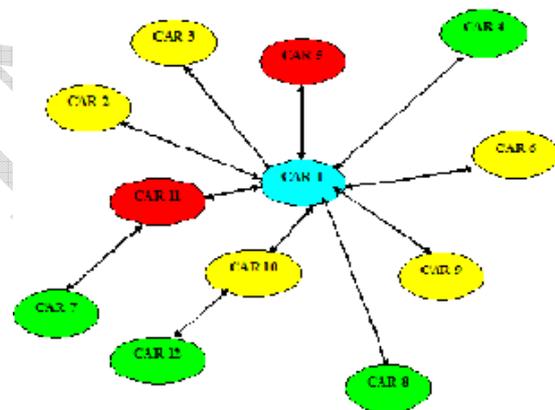
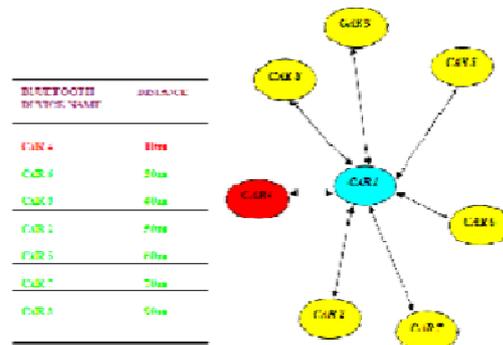


Figure5: The screen of the computer inside our car.

If a car comes within 10m, it is indicated by a red color (warning signal) in the computer and then it will send braking signal to the corresponding car. If there are more than 8 cars means, piconet extends to scatternet.

There is a problem during overtaking. This can be solved as follows. In the figure 5 the red car wants to overtake the blue car. The red car driver just touches the car in the computer that he wants to overtake. After receiving the signal,

the blue car driver allows the red car to go, after the acknowledgement signal is given by the blue car to the red car.

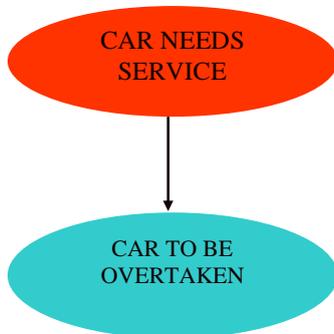


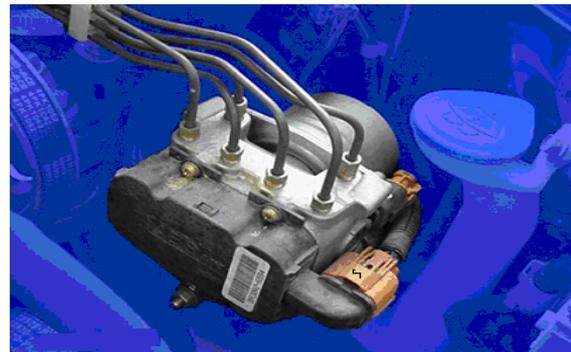
Figure6: Shows problem during overtaking and the solution

When any car comes close together, Bluetooth device sends warning signal to the car. Based on the type of warning signal received, the computer sends signal to the brake control system to slow down the speed of the car. There are various types of control signals. One type of signal controls the speed of the car and the other type of control signal is to overtake the car which is moving forward.

Automatic brake system:

The automatic brake system is the next generation braking system for controlling the speed of the car. On receiving the control signal from the traveling car, the computer inside the car manipulates the signal and gives control signal to the braking system. There are four main components of an automatic braking system:

- speed sensors
- pump
- valves
- controller



Automatic Brake System

The computer constantly monitors the distance between each of these cars and when it senses that the car is getting too close it moves the hydraulic valves to increase the pressure on the braking circuit, effectively increasing the braking force on the wheels. If the distance between two vehicles is within the 100m the Bluetooth devices get enabled and if the distance comes closer within 10m the automatic braking system takes the control. After the speed of the car is reduced, the hydraulic valves decrease the pressure on the braking circuit, thus effectively decrease the braking force on the wheels. The following steps show the various functions of the hydraulic valve:

- In position one, the valve is **open**; pressure from the master cylinder is passed right through to the brake.
- In position two, the valve **blocks** the line, isolating that brake from the master cylinder. This prevents the pressure from rising further and the driver's effort in pushing the brake pedal harder.
- In position three, the valve **releases** some of the pressure from the brake.

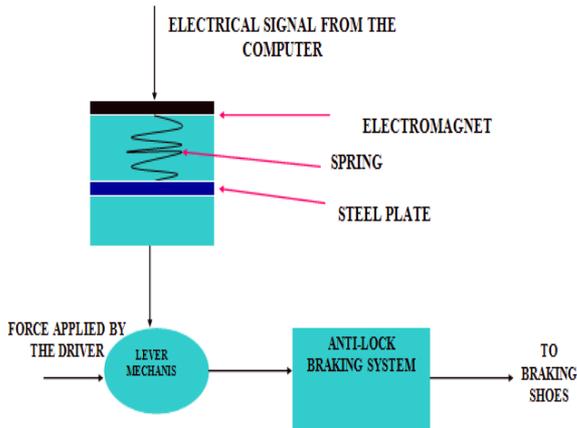


Figure7: Block Diagram of ABS

The processed signal from the computer is given to the electromagnet and it gets magnetised and moves the spring downwards, the other end of the spring is attached to the steel plate. The movement of steel plate is nothing but a force and it will add with the force applied by the driver. The signal is then given to the anti-lock braking system and it takes the control.

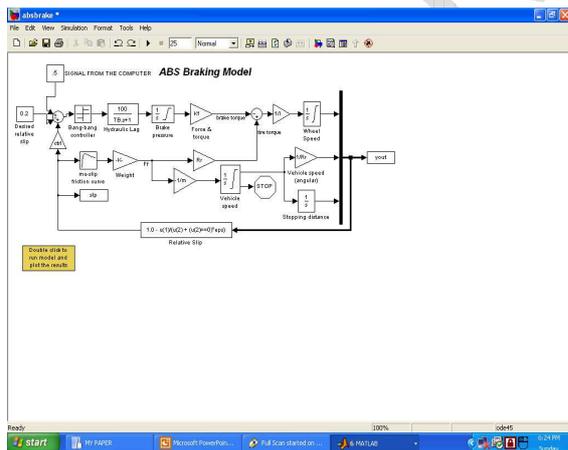


Figure8: Circuit Diagram

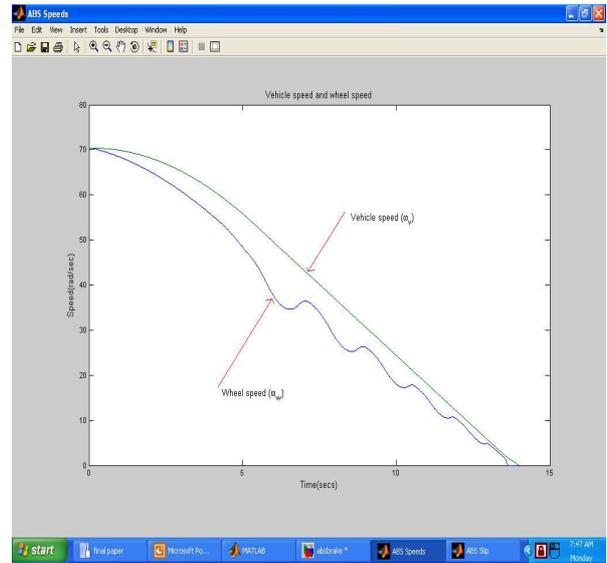


Figure9: Mat lab simulation for the automatic braking system including the signal from the computer

Conclusion:

The Bluetooth technology is being widely adopted by the Industry leaders. The possibility for new applications is very exciting with this versatile technology. It provides a simple logical answer to the entire problem, which built a single common radio into every mobile computer. Then companies have to worry about neither WAN nor building external cables. The Bluetooth communication device will thus be a small, low powered radio in a chip that will talk to other Bluetooth enabled products. Bluetooth has been designed to solve a number of connectivity problems experienced by the mobile workers & consumers. Thus, this technology is user friendly and helps address to various other problems like accidents.

IN PRINCIPLE NOD FOR SEMICONDUCTOR UNITS

The government, on 12 Sep 2013 gave in-principle approval to the proposal of setting up two semiconductor manufacturing facilities in the country in a bid to check over-dependence on import of electronic products, especially chipsets.

c. ARTIFICIAL VISION USING EMBEDDED SYSTEM

Introduction:

Genetic defects or injury may cause blindness at any time during the life of a person. The visually impaired are the most unfortunate people bearing darkness throughout their life. A blind man's quench for vision has made designated science to tour its journey. Since vision depends mainly on nervous system, it would mean trying to heal or change the nervous system. It would be better to tell -"we see with our brains than with our eyes". The sole principle used to visionise a blind is – **"DECEIVING OUR BRAINS"**.



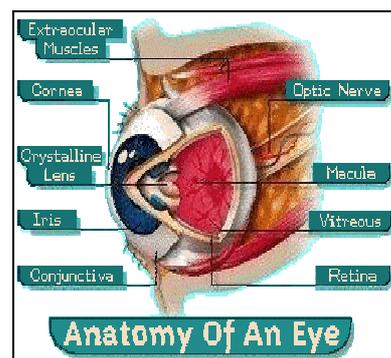
Image of an eye

Evolution in miniaturization, nanotechnology, image processing etc has paved way for vision. Blindness at any stage can be averted. Adaptability of humans made implantations flexible.

There are five different methods available for the noble cause of vision:

- Microchips.
- Nano tube implant.
- Digital artificial vision.
- Ocular prosthetics.
- Braille type writer.

Human visual system:



Anatomy of an eye

Prosthetics are artificial substitutions to the organs of the body which are disabled.

Neurons of the human visual system exhibit electrical properties.

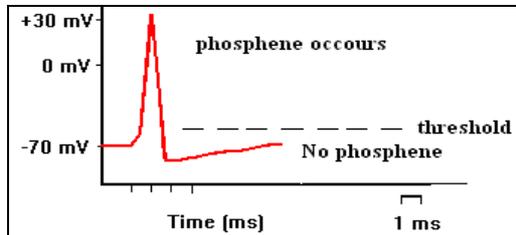


Figure10: Response relation between time and voltage

Neurons send and receive electro-chemical signals to and from the brain up to 200mph. The chemicals like sodium and potassium cause an electrical signal in the neurons. When a neuron is not sending a signal, it is “at rest”, then the inside of the neuron is negative with respect to outside. The resting membrane of the neuron is about 70mv. When the depolarization reaches about -55mv, the neuron then fire an action potential (signal). This is the threshold level. When the action potential is fired we start to visualize.

Retinal “transducer”:

An equivalent circuit of a retina is given through which the functions of Photoreceptors, Bipolar Cells and Horizontal cells are implemented.

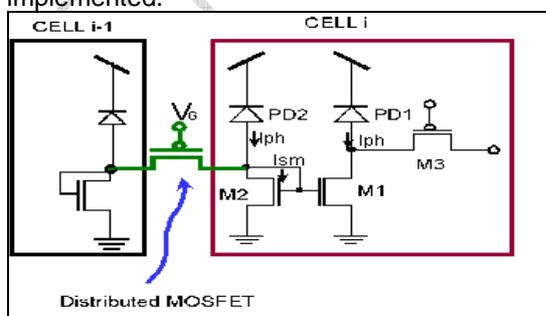


Figure11: Circuit Diagram

Digital artificial vision:

When a person is born blind, inwardly his optic nerve would not function properly, so we cannot use any retinal stimulation method.

The artificial vision system consists of

- Miniature camera mounted on eyeglasses
- Ultrasonic range finder
- Frame grabber
- Microcomputer
- Stimulus generation module
- Implanted electrode arrays.

Image processing (edge detection):

- Edge detection through SOBEL filters is the most common approach.
- The gradient vectors of SOBEL filter are G_x and G_y .
- The masks used to implement these two equations are called SOBEL operators

$$G_x = (Z_3 + 2Z_8 + Z_9) - (Z_1 + 2Z_2 + Z_3)$$

$$G_y = (Z_3 + 2Z_6 + Z_9) - (Z_1 + 2Z_4 + Z_7)$$

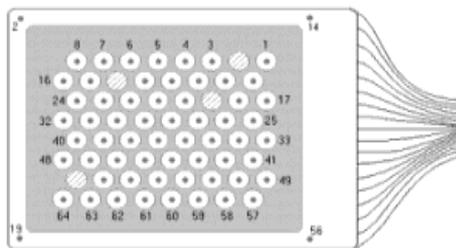
Microcontroller:

Controls the stimulating electrodes. Simulation delivered to each electrode typically consists of a train of six pulses delivered at 30 Hz to produce each frame of the image at a speed of 8 frames per second.

Electrode implantation:

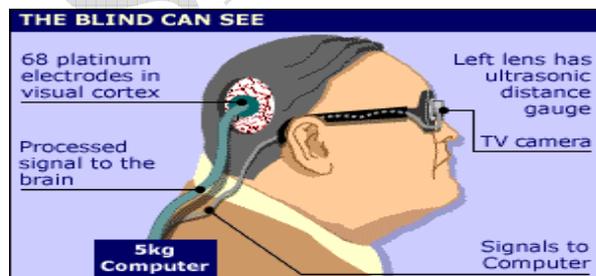
Electrode implantation is one of the most critical jobs in this artificial vision system. The first step done in this electrode implantation is perforating a platinum foil ground plant with a hexagonal array of 5 mm diameter holes on 3

mm centers on the skull at the right occipital lobe. 68 flat platinum electrodes of 1mm diameter are pierced from the center of the holes on the platinum foil ground plant into the nucleus of neurons of the occipital lobe. Each electrode is connected by a separate Teflon insulated wire to a connector contained in the pedestal.



Electrode Implantation

A group of wires from the belt mounted signal processor are connected to the connector mated to the pedestal. The groups of wires pass the electrical impulses which are generated by the processor with respect to the image being seen by the video camera. When the electrode is stimulated by the processor by sending an electrical impulse, the electrode produces 1-4 closely spaced phosphenes (light spots seen by visual field). By sending the electrical impulses in different combinations and permutations the phosphenes can be created in a regular fashion describing the image.



Electrodes connected with Human Brain

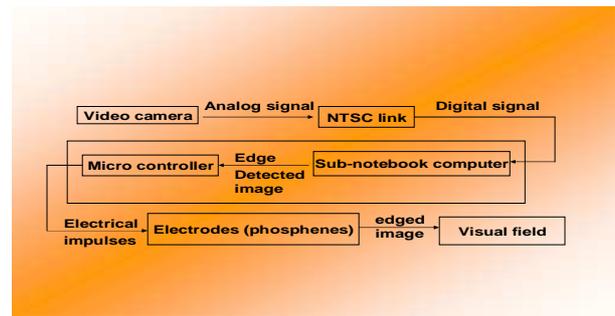


Figure: Process & the image created in the vision field of a blind human

Braille type writer:

- Used majorly for deaf blind, whose only mode of communication remains as sense of touch.
- A miniature glass is mounted as above.
- Using a signal processor synchronized signals are converted to pricking pulses, which is sensed on a pad interfaced on the stomach or hand of blind.
- Braille is a system of reading and writing using raised dots in cells of six that represents alphabets, pictures, obstacles etc.

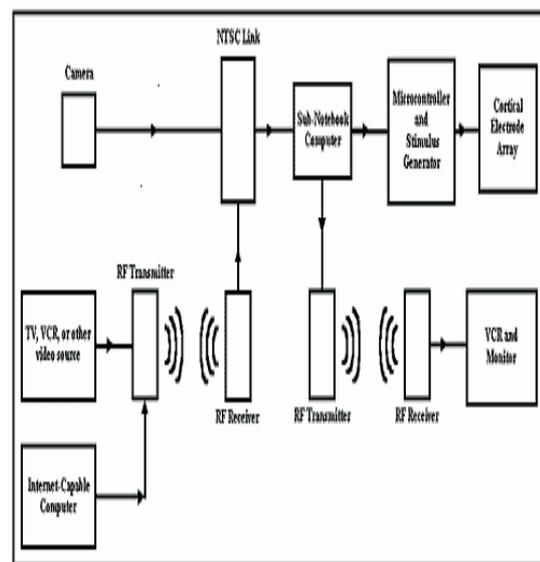


Figure12: Block Diagram

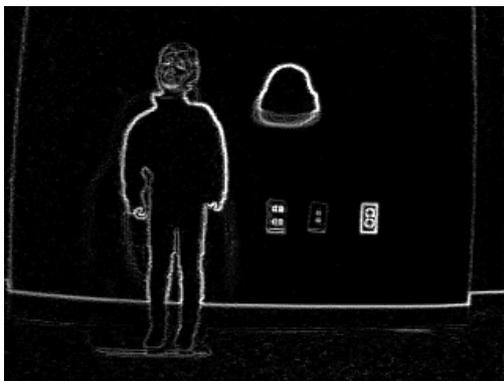


Figure13: The original image seen by the camera and the phosphene image seen by the visual field in the brain of the blind human

- Braille is written on heavy paper using either a slate and stylus, or a Braille-writing machine.
- The deaf-blind has to undergo training for about 6 months to one year as per his capability to grab.

Ocular prosthesis (false eye):



False Eye

- Traumatic accidents and treatment of ocular and orbital cancers, blind and painful eyes, and other diseases sometimes lead to the need for

reconstruction of the orbit (eye socket). Orbital implant is called Enucleation.

THINKING OUT OF THE BOX

A HR Interview Question:

You are driving along in your car on a wild, stormy night, it's raining heavily, when suddenly you pass by a bus stop, and you see three people waiting for a bus:

- * An old lady who looks as if she is about to die.
- * An old friend who once saved your life.
- * The perfect partner you have been dreaming about.

Which one would you choose to offer a ride to, knowing very well that there could only be one passenger in your car?

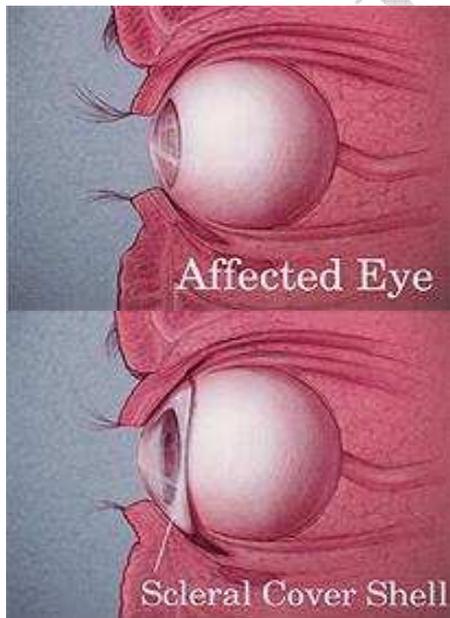
This is a moral/ethical dilemma that was once actually used as part of a job application.

He simply answered:

"I would give the car keys to my Old friend and let him take the lady to the hospital. I would stay behind and wait for the bus with the partner of my dreams."

Sometimes, we gain more if we are able to give up our stubborn thought limitations. Never forget to "Think Outside of the Box."

- The false eye is designed after taking mouldings of the patient's orbital tissues and eyelids, such that, the prosthesis fits nicely and comfortably.
- The BIONIC EYE implants are of porous polyethylene, (Medpor), and of aluminium oxide, (Bioceramic) or hydroxyapatite, kryolite glass or acrylic materials.
- After implant they allow blood vessels to grow in them.
- Usually there is a significant build-up of salt and protein deposits on the eye in one year's time. Polishing removes these potentially irritating deposits.
- Artificial drops are added to desilt eye.
- After orbital implant, it is difficult for the casual observer to distinguish the natural eye from the implant.
- Currently camera of 100*100 pixels has been implemented.



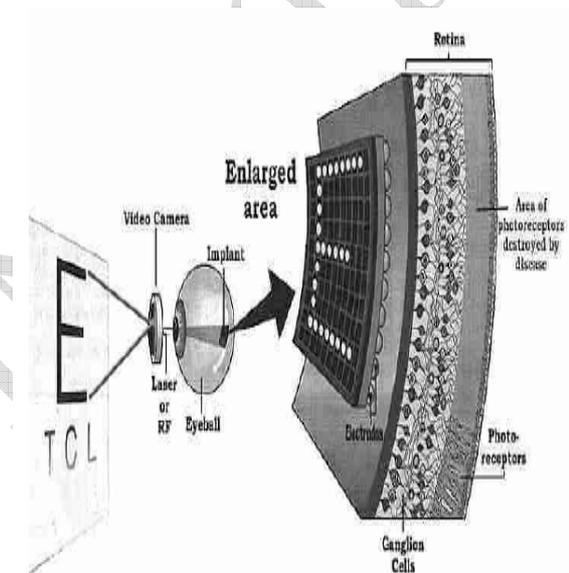
Affected Eye and Scleral Cover Shell

Nanotubes and Nanobatteries:

Nano Vision Chip System:

The Nano Vision Chip System consists of

1. A low Power CMOS camera mounted on a spectacle.
2. A Image processing device
3. Transmission device
4. Signal conditioner
5. Electrode array



Nano Vision Chip System

- Age related retinal diseases like macular disfunction, retinitis pigments can be averted using nano tubes.
- Normally, when light rays or images are focused by the lens of the eye onto the retina, light-sensitive cells called "rods" and "cones" convert the light in electrical impulses that travel to the brain and are interpreted as images of the world around us. The retina actually does some of the image processing and then sends this information to the brain, and so we see.

- CNT at Nano scale **reduces background noise, magnifies signal** and provides **desired redundance**.
- Zinc oxide nano wires are used here to transfer the signal from the signal conditioner to the CNT array.
- Nano batteries have long shelf life, predicted to last for 15-20 years.

The NVCS working can be studied as two parts – Intraocular and Extra ocular

Extraocular (Outside the Eye):

- The Images are received by the CMOS camera
- The microprocessor based image processor processes the images thus received. The processing may be either digital image processing or neural based image processing.
- The signal so obtained is PWM encoded and modulated using ASK.

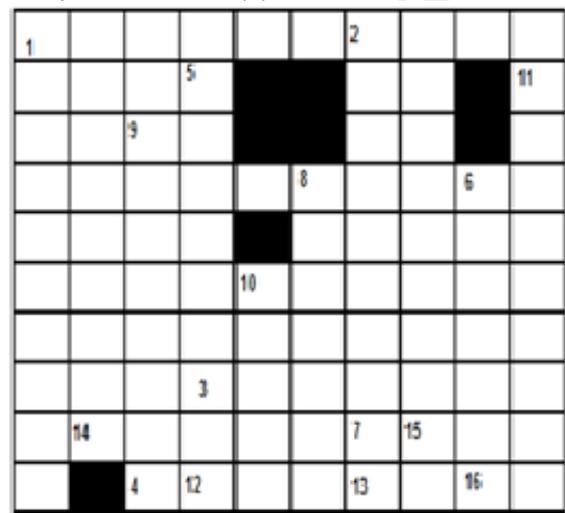
Conclusion:

As now, only black and white images are seen by this AVS system, research is being carried to visualize coloured images by using optical fiber technology. Research is being carried to replace the electrode implantation with ray or wave devices. Reduction of electrodes to 4, by operating into optic nerve directly involves usage of stimulator chip, radio antenna and signal processor. In the future the whole setup (excluding the camera) in NVCS can be nano fabricated on a single chip thereby making it more feasible and sophisticated.

CROSSWORD:

Left->Right:

1. _____ cooler - a semiconductor heat pump (7)
2. Magnetically activated switch (4)
3. Micro controller (3)
4. Super Fast Diode (8)



Right->left:

5. Temperature sensor (3)
6. Opposes current (8)
7. Electrically operated switch (5)

Top->Down:

1. Light to current/voltage (10)
8. Composite Thyristor (4)
9. Magnetic amplifier (6)
10. Inductor (4)
11. Linear Beam Vacuum Tube (8)

Down->Top:

12. Stores charges (9)
13. BJT (10)
14. acid/alkali based power supply (7)
15. RC network is used (8)
16. Array of pushbutton switches (6)

See the answers on page 28

MCET Catch

a. SEMINAR ON SERVICE ROBOTS:

In MCET, RLDC and ISTE clubs jointly conducted a seminar on the topic "Service Robots" by Dr. S. Saravana Kumar, Manager Engines (R&D), Mechatronics and Control Team, Mahindra Research Valley, M&M Ltd. He started the seminar with a video session. Here we describe the seminar.

Robotics is the intelligent connection of perception to action.

Types of robots:

- Industrial robots
- Service robots
 - Personal service robots (indoor) like domestic robots, home security and surveillance, personal transportation, education and entertainment, etc.
 - Professional service robots(outdoor) like field robots, inspection and maintenance, medical and health, construction and demolition, defence, rescue and security robots etc,..

Countries leading in robotics manufacturing in 2011:

In the present decade, the manufacturing of robots has increased rapidly with Republic of Korea as the leading manufacturer. Japan stands second and Germany stands third in this manufacturing

progression. Surprisingly UK stands last in this list and India did not acquire a position in this.

It is expected that in the fore coming years the manufacture of robots will increase due to the increasing demand for every year.

Underwater robots:

An underwater robot is a remote controlled or autonomous submersible vehicle which can be controlled and navigated to accomplish underwater task.

Need for underwater robots:

- About two-third of earth's surface is covered with water and almost 95% of it still remains unexplored. The reasons for need of underwater robots are:
 - It has huge impact on climate and weather conditions. So forecasts can be predicted.
 - Even for incurable diseases medicines are found in the depth of the seas, but it is not utilized because of unavailability of facilities to reach the depth where the medicines are found.
 - Most of the natural gases and resources remain unexploited in the oceans.
 - By 2040 the world population is expected to reach 9 billion and ultimately the demand for oil, food and other resources are also expected to enhance about 60%. Hence there is a serious necessity to explore the oceans.
 - The risk of human life in recreational diving can be eliminated by usage of this under water robots.

Major challenges faced by underwater robots:

- Uncommon and unknown environment.
- Constrains on communication.
- Tether/battery backup.
- High level intelligence.

Classification of underwater robots:

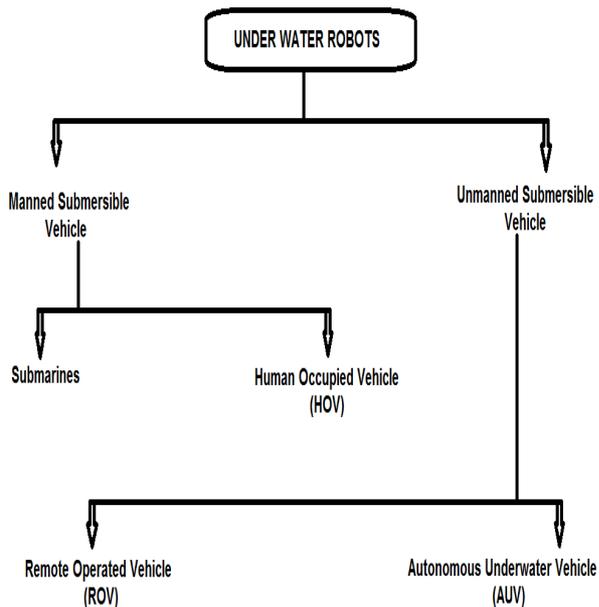


Figure 14: Classification of underwater robots:

Human occupied vehicle (HOV):

Human occupied vehicles allow humans to travel to more depths. But the facility is limited by battery and air supply. It is supported by light supporting system. It is quite large and complicated to operate.

Some examples of HOVs include Alvin, Thetis, Johnson sea link.

The HOV Deep sea challenger used by the film maker James Cameron has travelled up to a record distance of 36,070 ft.

Remote operated vehicle (ROV):

Remote Operated Vehicles cannot accompany human into the deep oceans instead it is controlled by pilots above the ocean level. It is connected to the ship with fiber optic cable and requires high skilled operators. It has unlimited capabilities and it is cheaper than HOVs. There are about 3500 ROVs available now.

Some examples of ROVs include inspection class ROVs, mid size and research ROVs and working class ROVs.

POODLE was the first manufactured ROV and it was built in the year 1953.

Applications of ROVs:

- Construction and maintenance of underwater structures.
- Underwater communication and power cable installation.

Autonomous under water vehicle (AUV):

AUVs are robotic device that is driven through the water by a propulsion system, controlled and piloted by an on-board computer and manoeuvrable in three dimensions.

Advantages of AUVs:

- Less operation cost.
- Reduced survey time.
- No operating fatigue.
- Safety.

Limitations of AUVs:

- Level of intelligence is not very high.
- Power source is limited.

- It has limited operational capabilities.

BRAIN TEASER

This riddle must be done
IN YOUR HEAD and NOT
using paper and pen or a
calculator. Try it!

Question:

Take 1000 and add 40 to it.
Now add another 1000 to it.
Now add 30. And another
1000.

Now add 20. Now add
another 1000. Now add 10.

What is the total?

Answer:

Did you get 5000? Way to
go. Most of us did, but that's
wrong. The answer is 4100.
Believe it: use a calculator.

Applications of AUVs:

- Academic field
- Defence (Monitoring, Detection)
- Marine science research

- Oil and gas industries.
- Underwater power lines
- Fisheries.
- Repair and rescue.

CONTROL ARCHITECTURE:

- Low level control includes navigation, sensors, AUV dynamic and actuators.
- High level control includes Human operator, planning and guidance.
- Intermediate control controls feedback and feed forward and backward laws.

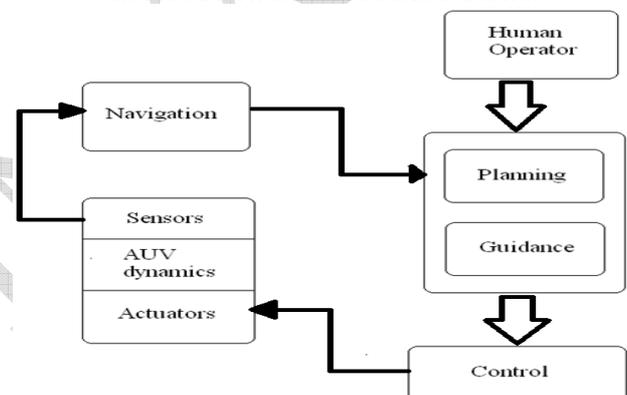


Figure15: Architecture

Types:

- Torpedo shaped
- Flat fish shaped
- Flexible fish shaped

Requirements:

- Stability and manoeuvrability.
- Easiness of control.

LATEST INVENTIONS:

a. DIGITAL PRESSURE SENSORS

Honeywell is pleased to announce its Digital Pressure Sensors with CANopen®. Model DPS, an addition to Honeywell's general

purpose pressure sensors that are configured with a variety of features and options for use in a wide range of demanding applications. Model DPS is rugged, stainless steel, all-welded device designed to work with a variety of media, and are built to provide consistent performance in harsh environments.



Pressure Sensor

Model DPS sensors are highly configurable. Configurations for digital measurements are fully temperature compensated and calibrated for pressure ranges from 10 psi to 10K psi or 1 bar to 700 bar or 70kPa to 70000 kPa, with accuracy ranges of 0.25% and 0.1%, and operating and storage temperature ranges from -25 °C to 85 °C [-13 °F to 185 °F]. The Model DPS with CANopen protocol communication allows customers to connect to longer cable distances without sacrificing accuracy.

Honeywell offers a broad portfolio of sensors which meet industry standard approvals such as ATEX, CSA, and more, and are built tough to provide enhanced reliability, accuracy, and versatility in a wide range of test and measurement applications. Honeywell's test and measurement sensor solutions help customers

worldwide in research and development, design, quality testing, manufacturing and system monitoring in many different industries, challenging applications, and rugged environments.

CANopen® protocol communication allows customers to:

- Connect to longer cable distances without sacrificing accuracy.
- Reduce the amount of wires that need to be connected to the system, simplifying installation.
- Mitigate data corruption.
- Simplify tracking each networked pressure sensor by using unique serial numbers.
- Configure the update rate between 10 Hz to 250 Hz, easing configurability.

Designed for Configurability – Customers can configure the devices to meet their specific application needs due to a wide pressure range, multiple pressure engineering units that eliminates making mathematical conversions, and a choice of connectors that simplifies usage.

Rugged and Durable – All-welded, 300 series stainless steel and Hastelloy® design allows for use in a wide range of harsh environments, while a mechanical shock rating of 100 G/11 ms and IP65 rating allow for use in harsh environments.

Accurate – Customers can select the accuracy level required for their application. Additionally, Honeywell specifies Total Error Band $\pm 2\%$ FS, the most comprehensive, clear and meaningful measurement that includes nonlinearity, repeatability, hysteresis and temperature error.

Availability and Support – Dedicated teams and manufacturing process provide a fast response to your design. Experienced application engineers understand the solution required to meet the most exact application needs.

FEATURES:

- Wide pressure range [from 10 psi to 10K psi or 1 bar to 700 bar or 70 kPa to 70000 kPa]
- Multiple pressure engineering units(psi,bar, kPa)
- Rugged, all-welded, 300 series stainless steel and Hastelloy® design
- Accuracy options include = 30 psi, ± 0.25 %FS or >30 psi, ± 0.1 %FS or ± 0.25 %FS
- CANbus with CANopen® protocol output
- Total Error Band [± 2 % FS] includes nonlinearity, repeatability and hysteresis as well as temperature error
- Designed for configurability due to a wide selection of pressure types, accuracy levels, pressure ranges, pressure connections and electrical terminations
- 5-pin M12 connector (for use in industrial applications) or 6-pin Bendix connector (for use in transportation applications)
- Mechanical shock 100 G/11 ms
- IP65 rated
- CiA (CAN in Automation) certified

POTENTIAL APPLICATIONS:

❖ Transportation

- Construction equipment
- Rail equipment testing
- Automotive test benches

❖ Industrial

- General industrial process control
- Factory automation/industrial equipment

❖ Medical

- Medical equipment systems (i.e., X-ray collimator, MRI scanning, etc.)

❖ Aerospace (non-ITAR)

- Test and research



Potential Applications

b. CRYSTAL ENGINEERING UPGRADES XP2i TEST GAUGE

Crystal Engineering introduced a 15,000 psi version of its XP2i test gauge. The one-year XP2i accuracy specification is 0.1% of reading with digital temperature compensation from -10 to 50°C. Each gauge includes an ISO 17025, NIST-traceable, calibration certificate with test data at 5 temperatures.

Key features include an IP-67 rated, marine-grade enclosure (submersible up to 1 meter), a fast pressure safety valve (PSV) mode, custom engineering units, and the leak-free Crystal pressure fitting connection. The dual display version adds additional features, including leak rate, tare mode, and differential pressure (when connected to a second XP2i).



XP2i Test Gauge

With the optional DataLoggerXP upgrade, users can record up to 32,000 data points and export the data into an easy-to-read Excel document. A new battery-optimizing, Ultra-Low Power (ULP) mode, allows more than an entire year of continuous recording on one set of AA batteries.

c. HEIDENHAIN INTRODUCES ECI 1319 AND EQI 1331 ENCODERS

HEIDENHAIN released ECI 1319 and EQI 1331 inductive, safety-related rotary position encoders. The ExI 13xx series rotary encoders provide a single encoder safety solution for many applications such as packaging, automation, and robotics.

The EQI 1331 rotary encoder has 19 bits of resolution in the single-turn range while tracking 4096 (12 bits) revolutions. The ECI 1319 is a single-turn encoder with 524,288 (19 bits) of resolution. Both the ECI and EQI encoders showcase improved vibration specifications (400 m/s² stator and 600 m/s² rotor), as well as a more durable multi-turn gearbox. These encoders also support the advantages of previous bearing less, inductive encoders, including non-contact design, resistance to contamination, no mechanical self-heating, and reduced sensitivity to radial run-out.



Encoder

Along with these advantages, the ExI 13xx encoders offer a host of additional safety-related functions. However, these functions are

available only with a safe control that supports the EnDat Safety Master, and can be implemented independently of the control-loop parameters. These safety measures work directly with a control's safety module.

DAILY LIFE INSTRUMENTATION:

a. ANTI-LOCK BRAKING SYSTEM:

Anti-lock braking system (ABS) is an automobile safety system that allows the wheels on a motor vehicle to maintain tractive contact with the road surface according to driver inputs while braking preventing the wheels from locking up (ceasing rotation) and avoiding uncontrolled skidding. It is an automated system that uses the principles of threshold braking and cadence braking.



ABS Brakes

ABS generally offers improved vehicle control and decreases stopping distances on dry and slippery surfaces for many drivers; however, on loose surfaces like gravel or snow-covered pavement, ABS can significantly increase braking distance, although still improving vehicle control.

Recent versions not only prevent wheel lock under braking, but also electronically control the front-to-rear brake bias. This function, depending on its specific capabilities and implementation, is known as electronic brake force distribution (EBD), traction control system, emergency brake assist, or electronic stability control (ESC).

Components of ABS:

- Speed sensors
- Valves
- Pump
- Controller

Speed sensors

The speed sensors, which are located at each wheel informs the anti-lock braking system when a wheel is about to lock up.

Valves

There is a valve in the brake line of each brake controlled by the ABS. On some systems, the valve has three positions:

- In position one, the valve is open; pressure from the master cylinder is passed to the brake.
- In position two, the valve blocks the line, isolating that brake from the master cylinder. This prevents the pressure from rising further should the driver push the brake pedal harder.
- In position three, the valve releases some of the pressure from the brake.

Pump

When the ABS system operates, the brake lines lose pressure and the pump re-pressurizes the system.

Controller

The controller is an ECU (Electronic Controller Unit) type in the car which receives information from each individual wheel speed sensor, in turn if a wheel loses traction the signal is sent to the controller, the controller will then limit the brake force (EBD) and activate the ABS modulator which actuates the braking valves on and off.

Working:

ABS brakes work by using an electronic signal to apply hydraulic pressure to the brake pads through the piston in the calliper. The piston is not just applied once and then released, rather it is applied many times to make a pumping action against the rotor or drum. ABS (Anti-Lock Braking System) ABS brake work through speed sensors, a computerized electronic control module and hydraulic control unit. When brake is applied, it will lock up all 4 wheels.

b. PRESSURE REGULATOR

A pressure regulator is a valve that automatically cuts off the flow of a liquid or gas at a certain pressure. Regulators are used to allow high-pressure fluid supply lines or tanks to be reduced to safe and/or usable pressures for various applications. Gas pressure regulators are used to regulate the gas pressure and are not appropriate for measuring flow rates. Flow meters, Rotameters or Mass Flow Controllers should be used to accurately regulate gas flow rates.

Operation:

A pressure regulator's primary function is to match the flow of gas through the regulator to the demand for gas placed upon the system. If the load flow decreases, then the regulator flow must also decrease. If the load flow increases, then the regulator flow must increase in order to keep the controlled pressure from decreasing due to a shortage of gas in the pressure system.



Compressed Gas Cylinder

A pressure regulator includes a restricting element, a loading element, and a measuring element:

- The restricting element is a type of valve. It can be a globe valve, butterfly valve, poppet valve, or any other type of valve that is capable of operating as a variable restriction to the flow.
- The measuring element determines when the inlet flow is equal to the outlet flow.
- In the pictured single-stage regulator, a force balance is used on the diaphragm to control a poppet valve in order to regulate pressure. With no inlet pressure, the spring

above the diaphragm pushes it down on the poppet valve, holding it open.

- Once inlet pressure is introduced, the open poppet allows flow to the diaphragm and pressure in the upper chamber increases until the diaphragm is pushed upward against the spring, causing the poppet to reduce flow, finally stopping further increase of pressure.

Single stage regulator:

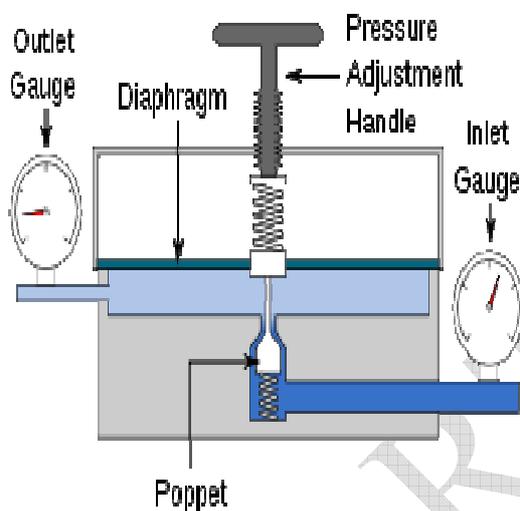


Figure16: Single stage regulator

When the spindle of the cylinder is opened slowly, the high pressure gas from the cylinder enters into the regulator through the inlet valve. The gas then enters the body of regulator, which is controlled by the needle valve. The pressure inside the regulator rises, which pushes the diaphragm and the valve to which it is attached, closes the valve and prevents any more gas from entering the regulator. The outlet side is fitted with a pressure gauge, which indicates the working pressure on the blowpipe. Upon the gas being drawn "off"

from outlet side the pressure inside the regulator body falls. The diaphragm is pushed back by the spring and the valve opens, letting more gas in from the cylinder.

Double stage regulator:

Two stage regulators are nothing but two regulators in one that operate to reduce the pressure progressively in two stages instead of one.

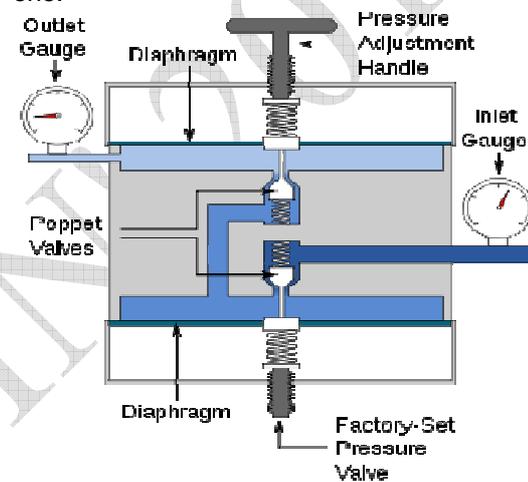


Figure17: Double stage regulator

The first stage, which is preset, reduces the pressure of the cylinder to an intermediate stage; gas at that pressure passes into the second stage. The gas now emerges at a pressure (working pressure) set by the pressure adjusting control knob attached to the diaphragm. Two stage regulators have two safety valves, so that if there is any excess pressure there will be no explosion. A major objection to the single stage regulator is the need for frequent torch adjustment. If the cylinder pressure falls the regulator pressure likewise falls necessitating torch adjustment. In the two stage regulator, there is automatic

compensation for any drop in the cylinder pressure. Single stage regulator may be used with pipe lines and cylinders. Two stage regulators are used with cylinder and manifolds.

Applications:

Air Compressors:

Regulators are used on the compressor itself to ensure that the tank pressure never reaches unsafe levels and to allow the user to adjust the pressure coming out of the tank to match what is needed for the task.

Cooking:

All modern pressure cookers will have a pressure regulator valve and a pressure relief valve as a safety mechanism to prevent explosion in the event that the pressure regulator valve fails to adequately release pressure. Most home cooking models are built to maintain a low and high pressure setting. These settings are usually between 7 and 15 PSI

Water pressure reduction:

Often, water enters water-using appliances at fluctuating pressures, especially in remote locations, and industrial settings. This pressure often needs to be kept within a range to avoid damage to appliances, or accidents involving burst pipes/conduits. A single-stage regulator is sufficient in accuracy due to the high error tolerance of most such appliances.

Oxy-fuel welding and cutting:

Oxy-fuel welding and cutting processes require gases at specific pressures, and regulators will generally be used to reduce the high pressures of storage cylinders to those usable for cutting and welding. Oxy-gas

regulators usually have two stages: The first stage of the regulator releases the gas at a constant rate from the cylinder despite the pressure in the cylinder becoming less as the gas is released. The second stage of the regulator controls the pressure reduction from the intermediate pressure to low pressure. It is a constant flow.

BRAIN TEASER

Can you name
three consecutive days
without using the
words Monday,
Tuesday, Wednesday,
Thursday, Friday,
Saturday, or Sunday?

Ans: Sure you can:
Yesterday, Today, and
Tomorrow!

Propane/LP Gas:

All propane and LP Gas applications require the use of a regulator. Because

pressures in propane tanks can fluctuate significantly, regulators must be present to deliver a steady flow pressure to downstream appliances.

Gas powered vehicles:

A specific pressure regulator will be necessary to bring the stored gas (CNG, Hydrogen) pressure from 700, 500, 350 or 200 bar (or 70, 50, 35 and 20 MPa) to operating pressure in addressing all safety and operational requirements.

Recreational vehicles:

For recreational vehicles with plumbing, a pressure regulator is a necessity. When camping, a source of water may have an enormous pressure level, particularly if it comes from a tank that is at a much higher elevation than the campground. Water pressure is dependent on how far the water must fall. Without a pressure regulator, the intense pressure encountered at some campgrounds in mountainous areas may be enough to burst the camper's water pipes or unseat the plumbing joints, causing flooding.

Breathable air supply:

Pressure regulators are used with air tanks for SCUBA diving. The tank may contain pressures well in excess of 2,000 PSI, which could cause a fatal barotraumas injury to a person breathing it directly.

Mining Industry:

As the pressure builds rapidly in relation to depth, underground mining operations require a fairly complex water system with pressure reducing valves. These devices must be installed at a certain distance.

STUDENT'S ARTICLE:

a. SMART GRID

Introduction:

"Smart grid" generally refers to a class of technology people are using to bring utility electricity delivery systems into the 21st century, using computer-based remote control and automation. These systems are made possible by two-way communication technology and computer processing that has been used for decades in other industries. They are beginning to be used on electricity networks, from the power plants and wind farms all the way to the consumers of electricity at homes and businesses. They offer many benefits to utilities and consumers -- mostly seen in big improvements in energy efficiency on the electricity grid.

How it is used?

For a century, utility companies have had to send workers out to gather much of the data needed to provide electricity. The workers read meters, look for broken equipment and measure voltage, for example. Most of the devices utilities use to deliver electricity have yet to be automated and computerized.

The "grid" amounts to the networks that carry electricity from the plants where it is generated to consumers. The grid includes wires, substations, transformers, switches and much more. Smart grid means "computerizing" the electric utility grid. It includes adding two-way digital communication technology to devices associated with the grid. Each device on the

network can be given sensors to gather data (power meters, voltage sensors, fault detectors, etc.), plus two-way digital communication between the device in the field and the utility's network operations centre. A key feature of the smart grid is automation technology that lets the utility adjust and control each individual device or millions of devices from a central location.

Applications:

The number of applications that can be used on the smart grid once the data communications technology is deployed is growing as fast as inventive companies can create and produce them. Benefits include enhanced cyber-security, handling sources of electricity like wind and solar power and even integrating electric vehicles onto the grid. The companies making smart grid technology or offering such services include technology giants, established communication firms and even brand new technology firms.

**GAYATHRI.S
III YEAR EEE**

b. 3G BASED AUTONOMOUS MONITORING ROBOTIC SYSTEM

Introduction:

An invention of steam engine by James Watt was an important turning point in history to trigger the industrial revolution. Industrial revolution by time transferred the life style of

people almost in the world. Since then every country is developing itself by expanding its industrial hands on almost all the fields. Countries like Japan are industrially developed countries. But countries like India lack in advancement due to various problems. One such small problem that has a great impact on industries such as power plants, oil refineries, chemical factors, boiler plants etc., is monitoring. Improper monitoring may lead to small leakage or faults leading to major accidents.

To resolve the above issue, comes our **3G based autonomous monitoring robotic system**, which has advanced features & numerous applications.

Abstract:

Robotics is an interesting field where every engineer can showcase his creative and technical skills. As the development of individual and cooperating autonomous robots advances, the need for a robust and reliable communication method becomes apparent. This paper summarizes the feasibility of implementing Dual-Tone, Multi-Frequency (DTMF) as an alternative mean of robotic communication to Radio Frequency (RF). The user in order to control the robot should make a video call to the 3G enabled phone attached in the Vehicle, from any another 3G enabled phone, which can send DTMF tones by pressing the numeric buttons and can view the video output. The cell phone in the Vehicle will be kept in auto answer mode. So, after a ring the cell phone accepts the call and starts video transmission. Now for the DTMF tones pressed,

the tones are fed to the circuit and the corresponding actions such as move forward or backward, turn left or right, target identification and locking, missile launching and parameter monitoring using black box are performed.

Our 3G based autonomous modified control system acts smartly by reducing our work in monitoring and surveying. This system consists of 3G modem, camera, DTMF circuit, and solar panel for recharging the batteries and many other controllers which co-ordinates the all features of the system and functions smoothly.

It works by a powerful 12V batteries which is rechargeable by an alternative solar panel as back up. It can easily be manoeuvred by using our simple 3G mobile phone from miles away by watching every Step of a vehicle using 3G technologies in the phone. It acts as an active assistant and can be continuously used to monitors all the process in the industry. It can be operated 24hours, even in dark as it as inbuilt LDR which detects light whenever the place becomes dark, it switches a torch which is connected to the vehicle. More options such as obstacle detector and fire extinguisher are also included.

Index Terms—DTMF technology, 3G wireless communication, LDR controller, Fire extinguisher.

Component details:

1. 3G modem/3G phone
2. Web cam
3. DTMF circuit
4. 12volt Ni-Cd battery

5. Solar panel
6. LDR controller
7. Obstacle detector
8. Geared motor

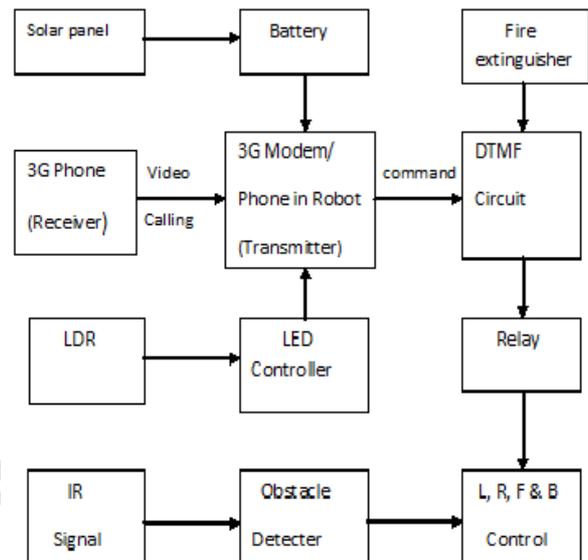


Figure18: Block Diagram

Working:

Working of this “3 based autonomous monitoring system” is simple. Here the 3g phone is mounted on robotic vehicle in such a way that its front camera should be facing front side of the robotic vehicle. Its output is given to a DTMF circuit through a 3.5mm audio jack. The DTMF output is given to geared motor through motor driver. An obstacle detector circuit is also interfaced with the motor driver. It consists of IR (Infra-Red) transmitter and receiver on both sides of the robot, hence collision can be avoided. The whole circuit is powered by a 12volt Ni-Cd battery and extra solar panel is also included for recharging. It can also be recharged by an External DC supply. When we call to the number mounted on robotic vehicle through our

3G enabled mobile phone, the phone will automatically attend the call. But for that we have to properly enable the auto answering mode of the phone mounted on the robotic vehicle. After attending the call, press the following keys to control the movement of vehicle.....

Press 2 and 8 for forward and backward movement of the vehicle.

Press 4 and 6 to determine the direction of the vehicle.

Press 1 and 3 to zoom in and zoom out of the camera.

Hence through this system we can lively watch the process going on around the area of the robot. In this robotic vehicle LDR circuit is also included, hence if the light insufficient for capturing the video, it will automatically turn on the light connected on the robot. As an additional feature fire extinguisher is added to suppress any small fire. This can switched on and off by using 7 and 9.

Advantages:

1. This robot can be used in the all industries.
2. It involves 3G communication; hence the video calling is high quality.
3. Even a small fault in the hard ware of the industry can be view through this system, hence major accidents can avoided.
4. This system is simple because function of the robot can be controlled by mobile itself.
5. This project is less cost (around 4000 RS)

6. LDR controller and fire extinguisher provides more advantages.

7. The battery can be recharged by both solar energy and external DC supply.

8. It can be applied in the field of defence for search and detect mines and also be used for surveillance in enemy terrorist & their activities.



Project Model

Disadvantages:

1. It can be used only in 3G network area.
2. Battery back-up provides only 6 hours if continuously working

Future implementation:

1. We are going to implement this system with the help of internet (Skype).
2. We will include temperature sensor, metal detector and bomb detector with help of MICROCONTROLLER.

**P.S.MUTHAMIL SELVAN,
M.ARJUN PRAKASH,
III YEAR, EIE.**

c. DESIGN, IMPLEMENTATION AND PERFORMANCE EVALUATION OF THIN FILM PHOTOVOLTAIC SOLAR POWER GENERATION

Abstract:

This project is to build a 2 kWp stand-alone solar power plant using thin-film PV cells and to study the performance characteristics of mono crystalline and thin film technology based solar power plant and establish a comparison report. The additional features of the system are the monitoring system and the data logging system. The secondary objective is to intimate the service personnel automatically if there is any interruption or there is tremendous decrease in the output power production which reduces the difficulties in maintenance. This system also has provision that sends information regarding total units produced in a day, week, month, etc.

Thin film PV cell technology:

The *Thin-Film or Amorphous Silicon (A-Si)* is a type of panel where silicon is deposited in a continuous on a base material such as glass, metal or polymers and it gives most cost effective renewable energy solution. Thin-film crystalline solar cell consists of layers about 10 μ m thick compared with 200-300 μ m layers for crystalline silicon cells. The Voltage Rating (V_{mp}/ V_{oc}) is 72%-78% and its temperature coefficients are lower, the module efficiency ranges 4%- 12% and requires up to 50% more space for a given project size. Thin films always give 30% more energy per year in

hot climates than Crystalline panels.

Data logger system:

The following parameters are measured by this system

- Voltage, Current, Temperature, Radiation Intensity.
- The performance curve of this technology will be displayed in Internet in day wise, week wise and then even as year wise.

K.K. ANAND KUMAR (10BEE104)

E. BALAMUGUNTAHAN (10BEE205)

G. KARTHICK (10BEE120)

FINAL EEE

CROSSWORD ANSWERS:

Left->Right:

- 1.Peltier
- 2.Reed
- 3.PIC
- 4.Schottky

Right->left:

- 5.RTD
- 6.Resistor
- 7.Relay

Top->Down:

- 1.Photodiode
- 8.IGBT
- 9.Toroid
- 10.Coil
- 11.Ignitron

Down->Top:

- 12.Capacitor
- 13.Transistor
- 14.Battery
- 15.Snubbers
- 16.Keypad

A DAY AT AN INDUSTRY

Our SMARTIN team had visited a private paper mill to gather some information regarding the process that takes place in the factories. Newsprint, crafts, posters etc. are produced here using the waste papers by recycling.

Most of the paper industries in south India produce paper by recycling process and not directly from the pulp. The raw materials that are the waste papers are obtained from all over the nation and are also imported.

Types:

There are four types of machines employed in these types of industries are

1. Two MF machines(Machine Finish)
2. One MG machine(Machine Glazee)
3. One Duplex Board machine

Production:

The MF machine produces paper for newsprint, printing and writing. The MG machine produces paper for crafts, notices, posters and tissue papers and the Duplex board machine produces duplex boards

Process:

The waste papers are sorted thoroughly. This sorting process is done manually. The sorted raw materials are passed through chain turbine for cleaning. Then it is passed through a high consistency pulper. Slushing with water takes place for 15 minutes. After slushing bleach is added for removing colours and impurities. Sodium hypochlorite NaOCl_2 is used as a bleach

and then it is discharged. While discharging, the strands are passed through synal pipe having 6mm hole which absorbs only 6mm fibres and less than it. The fibres greater than 6mm are eliminated.

The fibres kept in a chest which looks like a tank are then passed to the high density cleanser. The impurities like sand, dust, etc. are removed through centrifugal action.

Then it moves to the medium consistency stream which has a basket of 1.4x0.5mm that allows only particles 0.3mm. The 0.3mm particles are passed through a vibrating stream which is like a sieve plate where the plastics are eliminated

Then the stack goes to the thickening unit. After thickening it is moved to the dispersing unit. Before dispersion the stack is heated in a boiler at 90°C. Dispersion unit has two disks will knife while cuts the fibre again and again then it is sent for refining.

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SMARTIN' 2014