NATIONAL INSTITUTE OF TECHNOLOGY, TRICHY

# IC407 -PRODUCT DESIGN AND DEVELOPMENT

**Product Summary** 

Department of Instrumentation and Control Systems Engineering NIT-Trichirappalli.

<u>Batch – 1</u> I - STAMP

# Patient Database and Monitoring system equipped with online pulse rate monitoring using Smartphone

### **Brief Introduction**:

The product is an IOT based model whereby an inanimate object with pre-defined specifications can be uniquely linked to a corresponding record on an online database. The applications include:

- Access to medical record of a patient by an EMR during emergency situation.
- Universalization of medical records including prescriptions, X-Ray reports, scan reports, EEG, ECG. Etc. maintained across hospitals.
- Real time remote monitoring of patients' pulse rate.

### Major Components of the product development:

The product development process can be classified into two major components:

- **Software:** The development of corresponding web application for database access and maintenance.
- Hardware: The design of stamp that can be uniquely detected by a touch screen device.
- **IOT**: Real time data communication between pulse rate detector and Web Application.

### Software:

- The software is being built on Google's **GAE** (**Google app engine**) platform which provides free hosting for web applications of limited size constraints.
- The web application is responsible for user authentication based on the I-STAMP and also for access and maintenance tasks of user database.
- Microcontroller programming was achieved using Energia software.
- Real time Pulse graph using Plot.ly.

### Hardware:

The hardware component involves design of 3D model for the I-STAMP. Options that have been considered:

- Using CAD software to design a 3-D printable model that has uniquely identifiable protrusions that can be detected by a touch screen mobile phone, tablets, laptops, PCs and other hand held touch enabled devices.
- Using already existing common items to provide identifiable protrusions by providing a conductive coating.



# <u>Batch – 2</u>

### **GSM EQUIPPED FIRE ALARM SYSTEM**

### **INTRODUCTION:**

Traditional smoke is limited in their function for they are able to indicate the presence of smoke and send a sounding alarm to the surrounding area. However, what if nobody is present in the environment where the fire has started. Square Smoke is an advanced smoke and gas detector in which not only can detect smoke or gas, but it scan the environment for any physical movement and send that information to your cellular device.

### PRODUCT OBJECTIVE:

Our goals of this product is to protect the user(s) home as well as their well-being. In this product, the achievement goal is the safety of the user(s) investment. The user(s) can alert the proper authorities such as fire department, police, and hazard control base on the instant alert from Detector.

### PRODUCT DESCRIPTION:

The materials that are used to construct this project are the following: MQ2 Smoke and Gas Sensor, Buzzer, Arduino GSM SIM 900 Shield Unlocked, and MSP430 Microcontroller Board and Wires. Once constructed, the project is safe guarded from any electrical exposure by a heavy duty plastic casing which acts as an insulator to provide safety from any electrical exposure to the user. The software that interfaces the cellular devices with the product for alarming is Energia, which is an open-source electronics prototyping platform started by Robert Wessels in January of 2012 with the goal to bring the Wiring and Arduino framework to the Texas Instruments MSP430 based Launchpad.

### PROBLEM SOLVING PROCESS:

Time and communication are the key components for this product. In order for this product to be successful, the time must be executed correctly as well as communication. We have used our microprocessor programing skills we have learned in order to program the Arduino boards. With keeping the problem solving in mind, troubleshooted the components while writing the program for the microprocessor chip for the Arduino Board. This process took even more time than we anticipated. However, by having great communication as well as dividing the work and working together, we took each problem step by step and figured out and understood the output.



# <u>Batch -3</u> <u>SMART SECURITY SYSTEM (IoT)</u>

In the present world, where everything is controlled by a touch on the phone, why not make home security smart too? This question drove us to our product – Smart security system using IoT. There are burglar alarm systems available in the market by established companies such as Phillips, Godrej etc which perform a similar task as our security system. So what makes our Smart security system different from those available at the market?

Before answering that question, let us first discuss about the product. The main components of the burglar alarm are:

- 1. Arduino (Rs.400)
- 2. Ultrasonic sensor HC-SR04 (Rs.150)
- 3. Piezo buzzer (Rs.100)
- 4. GSM Module 300 (Rs.750)

The fundamental design consists of Ultrasonic sensor connected to Arduino on pin 12 as the echo pin and 13 as the trigger pin and the piezo buzzer connected via pin 8. The trigger and piezo buzzer pins are output and the echo pin is input. The maximum trigger distance can be adjusted in the code that is burnt into the Arduino.

The principle working of the product involves sensing an object in front of the ultrasonic sensor that senses obstacles using echo principle. The presence of obstacle in front of it at a distance lesser than or equal to the specified distance triggers the trigger pin in the Arduino. The Code flashed onto the ardunio senses the interrupt and activates the GSM module to send a message to the mobile number stored in it. At the same time, the piezo buzzer is activated.

This product can be used at front doors of the house, in cupboards, hostel rooms etc. Because of its economical price of assembling, the product can be used by households of lower income and by students who can't afford branded alarm systems.





# <u>Batch – 4</u> <u>BIOMED</u>

### **OBJECTIVE:**

To develop a body fluid concentration indicator that can measure the concentration of any elements like nitrite, glucose, potassium, Sodium, Chloride etc. in our body fluids. The unique feature of the product is the ability to test any body fluid with just the simple and handy equipment and one measurement will be sufficient to find many concentrations precisely.

### **SCHEMATIC:**



### WORKING:

- The 3 electrode system obtains the input concentration and produces a voltage according to the input concentration.
- The signal conditioning circuit filters the inherent noise in the signal and amplifies it to 05V as required by the arduino board.
- This signal is then transferred to the PC through the Arduino mega 2560 microcontroller.
- The obtained data is then processed through java to obtain a plot of voltage versus current and then linked to the concentration versus current graph to obtain the final result.



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🍃 Python 2.7.10 Shell

<u>File Edit Shell Debug Options Window H</u>elp Python 2.7.10 (default, May 23 2015, 09:40:32) [MSC v.1500 32 bit (Intel)] on n32 >>> Sending Email To:renu112092@gmail.com From: renu112092@gmail.com Subject:report

>>>



### <u>Batch – 5</u> <u>SMART AGRICULTURE USING GSM</u>

### **Project Objective:**

- 1. To measure water or moisture content in the soil
- 2. To transmit the output data through GSM

### **Idea Generation:**

Demand for the efficient usage of water resources in agriculture. The scope to improve the present technologies that are assisting in the monitoring of several different aspects of yield of crops.

### Working Principle:

Moisture level sensor works on the principle of electrical conductivity measurement. Which is measured by inserting two electrodes of opposite conductivities in the soil and its conductivity level depends on the moisture content in the soil and accordingly voltage output is varied. This is calibrated and moisture level is detected.

#### **Product Description:**

Sensor output is connected to aurdino board which senses the level of voltage output for moisture level . Aurdino board has a comparator that compares with required level and gives high or low output. This output is given to microcontroller through which LCD display and GSM module are connected and activated.





### <u>Batch – 6</u>

### Automatic Waste Segregator : Project Overview

In recent times, garbage disposal has become a huge cause for concern in the world. A voluminous amount of waste that is generated is disposed by means which have an adverse effect on the environment. The common method of disposal of the waste is by unplanned and uncontrolled open dumping at the landfill sites. This method is injurious to human health, plant and animal life.

Currently there is no system of segregation of biodegradable, plastic and metallic wastes at a household level. The purpose of this project is the realization of a compact, low cost and user friendly segregation system for urban households to streamline the waste management process.

#### **Proposed Solution:**

Waste is pushed through a flap into the proposed system. An IR proximity sensor detects this and starts the entire system. Waste then falls on the metal detection system. This system is used to detect metallic waste. After this the object falls into the capacitive sensing module. This module distinguishes between wet and dry waste. After the identification of waste, a circular base which holds containers for plastic, biodegradable and metallic waste is rotated.

The collapsible flap is lowered once the container corresponding to the type of garbage is positioned under it. The waste falls into the container and the flap is raised. The waste in the containers now can be collected separately and sent for further processing.



Figure 1: Automated Waste Segregator



# <u>Batch – 7</u>

### **MASTER REMOTE CONTROLLER**

### **Project Introduction**

We aim at integrating concepts of IoT & automation and present our Master Remote Controller – A WiFi controlled device which is capable of controlling any instrument or appliance at any place in the world with just a tap on your smartphone.

### **Applications**:

- Home & Office automation: The device can be connected to any wireless network like the home or Office network. The application provides the means to remotely switch ON/OFF the spike buster. Operating security systems and controlling the level operations of a domestic water tank to the preheating of your food and actuation of air conditioning unit and washing machines , etc.
- **Smart Industries**: Removes the need of many laborers to be present at site for governing various processes. From controlling the valve pressure of a steel industry to when to stop adding a pacifier rod in a critical radioactive reaction, all this can be automated and control just at with a click.
- **Health Care**: Will add a huge boost to automated health monitoring of patients. Faster diagnosis and better health care by doctors, providing them with real-time access to biological parameters of a patient. Also eliminates the need of additional nurses.
- **SDisaster Management**: In actuation of emergency alarm systems, emergency control valves and forecasting of natural calamities. Fast response in disaster recovery management.

### **Technical Aspects**:

The product makes use of the latest TI CC3200 WiFi enabled transceiver that enables remote control of any appliance over 802.11.

The major elements of the signal conditioning circuit consists of a voltage regulator, LM-324 (Comparator) and Potentiometer.

The processed output triggers the load circuit by actuating the relay circuit.

By implementing the server-client architecture in CC-3200, we can request the IP address of the processor and henceforth gain control over the entire system through mobile.

The major benefit of this technology is that it is not limited by availability of internet connection. It has the capability to create its own hot-spot.











### <u>Batch – 8</u> <u>MULTIPURPOSE SOUND DETECTOR</u>

#### **INTRODUCTION:**

The multi purpose device is meant for sound detection which are in audible range (20 to 20khz) The device major applications are :

- 1) Burglar alarm.
- 2) Spying purpose.
- 3) Safety device in industrial application

#### WORKING PRINCIPLE

The input to the condenser mic is sound signal from the surrounding environment. It is converted into electric signal in the order of millivolts (mv). The  $10K\Omega$  potentiometer is used in order to adjust the pull up resistor for the mic so that it can meet the supply requirement of the mic. The circuit has been designed for different mics and hence a potentiometer is used so that one can readily adjust it according to his necessity.

The output of the mic being in the order of mv, it is very difficult to work with such small magnitude of voltages. Hence, we use an amplifier with high gain to convert this low voltage to voltage in the order of volts (V). Here, one of the four op amps of the IC LM324 has been used for this purpose.

The capacitor  $C_1$  blocks the DC voltage coming from the supply voltage and allows only the sinusoidal component of the input sound signal to pass through it. The combination of  $C_1$  with  $R_1$  forms the high pass filter circuit which blocks the low frequency input signal as well as the DC input. The resistors  $R_2$  and  $R_3$  has been selected as  $1K\Omega$  and  $100K\Omega$  respectively so as to provide a gain of 100 in inverting mode of operation of the op amp.

Thereafter, the amplified voltage reaches the peak detector circuit through a diode. The diode allows only the positive waveform to pass through it. In the peak detector circuit, the capacitor charges through the diode, holds the peak voltage for certain duration and thereafter discharges it through the resistor  $R_4$  when the diode does not conduct. A higher value of capacitance holds the voltage longer as it discharges slowly due to high time constant, hence it would not cause variation in the indicator LED with variation in the input sound signal.

Finally, the voltage across the capacitor is given as input to a comparator to compare against a minimal voltage of 0.42 Volts, which has been chosen so as to minimise the effect of noise on the comparator output. This has been set by choosing proper values of  $R_5$  and  $R_6$ The LED is connected at the output in series with a 220 $\Omega$  resistor  $R_7$ . The LED glows as and when the comparator output is HIGH i.e. as long as the capacitor is able to hold the voltage.





# DUAL AXIS TRACKING OF A SOLAR PANEL

#### **ABSTRACT:**

The recent decades have seen the increase in demand for reliable and clean form of electricity derived from renewable resources. One of them is the solar energy. The challenge remains to maximize the capture of solar rays for conversion. This project concentrates on the fabrication of a solar panel mount with a dual axis solar tracking controller. This is done so that the rays of the sun falls perpendicularly on the panel to maximize the capture of the rays by pointing the solar panel towards the sun and following its path across the sky.

#### **INTRODUCTION:**

Electrical energy from solar panels is derived by converting energy from the rays of the sun into electrical current in the solar cells. The main challenge is to maximize the capture of the rays of the sun upon the solar panels, which in turn maximizes the output of electricity. A practical way of achieving this is by positioning the panels such that the rays of the sun fall perpendicularly on the solar panels by tracking the movement of the sun. This can be achieved by means of using a solar panel mount which tracks the movement of the sun throughout the day. Energy conversion is most efficient when the rays fall perpendicularly onto the solar panels. Thus, the work is divided into three main parts namely the mounting system, the tracking controller system and the electrical power system.



# <u>Batch – 9</u> <u>TRI WHEEL TROLLEY</u>

Our product's name is **TRI WHEEL TROLLEY.** As the name suggests, our product is an external use trolley to carry luggage and any type of day to day goods. But wait, what so special in a trolley; the best is yet to be explained. Our product is a trolley with three wheels different from all other conventional ones. The main purpose served by the three wheels is it allows the trolley to climb stairs without any hindrance. Many of us live in apartments or two storey house where carrying luggage is a painful task. Our main aim is to ease this task, and here we are with our product.

Be it carrying day to day household goods off the shelf down the stairs, or be it carrying your backpacks up the stairs in railway station, **TRI WHEEL TROLLEY** makes it a piece of cake. The product appears just like any other trolley but with three wheels each positioned at 120 degree with other. This particular arrangement makes it possible to carry any luggage on the trolley up and down the stairs. The product is made from PVC pipes with adjustable resting handle. The product is sturdy enough to carry 20 kilogram of weight.

It took us a month to decide upon the product dimension and come with the final layout. Since we are instrumentation students and our product is a pure mechanical one, we faced a lot of difficulties in our alpha prototype. Once we got a fair enough idea, it was easy to shape the product into a marketable one. The estimated price of the product is Rs 800. The price has been kept so keeping in view the affordability by all the income groups.





# <u>Batch – 10</u> <u>PIEZO SOLAR POWER BANK</u>

### About the product:

The mechanical movement of the human body in the daily life of a person, can generate enough power to charge our mobile devices, more specific way, this energy is generated when walking, using a piezoelectric device that can generate a potential difference when pressed. Therefore the principle of generating electricity when walking can solve the problem of mobile phone batteries, so to charge your device you will have to get in action, for that reason the product is: "Move it -Charge it ", that means, move you to charge your device. We have also integrated a solar panel along with the Piezo so that Sunlight can also be used to charge the power bank.

### Working:

In the following product we are using two different circuits for the voltage outputs from the solar panel and from the piezo sensor .The solar panel gives the output of 300ma and this output is connected to the switching circuit along with the piezo output of 5v coming from the piezo sensors .Then the output from the switching circuit based on to what we switch is given to the usb convertor which gives the output of 5v which is used to charge the device. Also the output from the switching circuit can be used to charge the rechargeable batteries too.









# <u>Batch – 11</u> <u>Automatic Irrigation System</u>

The project is intended to implement the idea of an automatic irrigation system. The system will check if the soil is dry, moderately wet or wet. The land will be irrigated for a larger span, a smaller span or it will not be irrigated at all depending upon the water content of the soil .The user need not worry about the amount of water that is to be supplied. To realize this system the humidity of the soil is checked and as per the sensor output and the land is irrigated. It does not require any human inputs once turned on. The project may be used in gardens and large farms with multiple sensors. Such systems can also be used for domestic purposes like watering a plant, a garden or a lawn.



The project is implemented in 5 sections:

First stage comprises of a sensor to sense moisture content in soil. Next is the sensor to microcontroller interfacing circuitry. The third stage is a microcontroller to initiate and control watering followed by microcontroller to solenoid valve interfacing circuitry. Finally we have the solenoid valve to water the soil.







# <u>Batch – 12</u> <u>Braille translator and printer</u>

**Problem tackled:** There are a lot of literature and books available in print and in e-copies for our reading but the same is not made accessible to the visually challenged. They have to depend heavily on braille tablets or gadgets like laptop, that though nowadays are becoming user friendly and customised for them, are still expensive. A lot of schools teaching blind students still use braille as a primary tool and braille literature is very limited to the standard few textbooks and materials. On the other hand even if braille e-copy is accessible, their printing is very costly. On an average small-volume Braille printers cost between **\$1,800** and **\$5,000** and large-volume ones may cost between **\$10,000** and **\$80,000**.

**Our product:** We are suggesting a braille translator and printer that is cost effective while being at the same time easy to use. Our product involves taking a picture of the given textual material in any camera available in phone or computer, sending it to a main server having python IDE where Optical Character Recognition(OCR) is performed on it and then transmitting data serially to the microcontroller. The microcontroller actuates the modified printer mechanism and the braille cell used.

- **Printer:** The printing mechanism is very simple for the braille cell. The exoskeleton would contain the feeder for the paper, rolls for turning the sheet, and 2 parallel rods for a clamp containing the braille cell to move on. A DC motor would enable the roll and the clamp to move across the paper. Our working model contains only the clamp and rod support as feeder mechanism needs a custom made design.
- **Braille Cell:** We suggest custom made braille cells for the printing mechanism. Our model consists of a sample cell for the design. It has small cylindrical tubes embedded in the cell, which has a smaller diameter cylindrical rod that will move within it for the embossing of the braille paper. It works with a small 5V DC motor. It should be a 3X2 grid with standards and dimensions as specified by the de facto values put forth in Specification 800, "Braille Books and Pamphlets," from the National Library Service for the Blind and Physically Handicapped of the Library of Congress.

# <u>Batch – 13</u>

# Alcohol detecting mechanism for vehicles

### **Description:**

The main purpose behind this project is "Drunk driving detection". Now a days, many accidents are happening because of the alcohol consumption of the driver or the person who is driving the vehicle. Thus Drunk driving is a major reason of accidents in almost all countries all over the world. Alcohol Detector in Car project is designed for the safety of the people seating inside the car. Alcohol breath analyzer project should be fitted / installed inside the vehicle.

### **Description in detail:**

The main unit of this project is an "Alcohol sensor". If the person inside car has consumed alcohol then it is detected by the sensor. Sensor gives this signal to a comparator IC. The output of comparator is connected to the microcontroller. Microcontroller is the heart of this project. It is the CPU of the complete circuit. Microcontroller gives high pulse to the buzzer circuit and the buzzer is turned on. At the same time a relay is turned off. Due to this the ignition of the car is deactivated.

### **Applications and Advantages:**

### Applications of Alcohol Detector in Car:

1) "Alcohol Detector project" can be used in the various vehicles for detecting whether the driver has consumed alcohol or not.

2) Breathing analyser project can also be used in various companies or organization to detect alcohol consumption of employees. Alcohol detection system in an automobile is a must feature which every cab or bus should have.

### Advantages of Alcohol Detector project:

1) "Alcohol Detection System in Cars" provides an automatic safety system for cars and other vehicles as well.

### Future Development:

- 1) We can implement GSM technology to inform the relatives or owners of the vehicle about the alcohol consumption.
- 2) We can implement GPS technology to find out the location of the vehicle.





### <u>Batch – 14</u>

### PORTABLE SOLAR LAMP

#### Rationale for Solar lamps:

Lot of villages in India are still using kerosene lamps and are widely affected by frequent power cuts. By using solar lamps, we can provide a convenient and cost-effective way to light streets at night without the need of AC electrical grids for pedestrians and drivers. Even with advent of LED and CFL lamps, Solar energy act as an efficient and renewable source of energy helping us illuminate thousands of life.

#### Differentiation:

Our team "Lumos' has built this design of the lamp on the basis of the following aspects,

1. High intensity light should be used so that by tilting the head of the lamp, the whole room can be illuminated. In villages, this might be a crucial need as the study lamp can be alternately used for some other purposes as well.

2. We have eliminated the gooseneck arrangement found in conventional models, We have made a rigorous analysis on the best user friendly design and come up with this solution.

3. We will be making the base translucent through 3D Printing. By making the base of the lamp translucent where the electronics of the lamp belongs, the children will be particularly interested in knowing more about the working of the product rather than just use it for study purposes. This is a very crucial design fix as we will be inciting curiosity in the minds of young children, and this will go a long way in making the dream of the Solar urja lamp come true.

4. The assemblage is quite easy as there are just four parts that have to be grouped together.

5. We are using Lead Acid batteries in our application for its simple storage and transportation, and due to its environment friendly and recycleable nature.



# <u> Batch – 15</u>

### **GRAVITY LIGHT**

### **INTRODUCTION:**

Over 1.3 billion people don"t have access to electricity. Millions more have unreliable and sporadic supply, meaning that over 2 billion people rely on biomass fuels such as kerosene for light. The electricity grid is growing but is not keeping pace with population growth. **GravityLight** is a gravity-powered lamp designed for use in developing or third-world nations, as a replacement for kerosene lamps.

### **PRODUCT VISION:**

To serve the common man by eliminating kerosene lamps and their damaging effects

### **MISSION STATEMENT:**

### **Product Description**

GravityLighta gravity-powered lamp developed to provide clean, reliable and safe light, enabling people to break free from the economic, health and environmental hazards of kerosene lamps.

### Key Business Goals

Technology with a purpose Targeting 20% of the world's population that do not have access to electricity.

### Primary Market:

Poor household with no electricity. Natural disaster relief camps. Normal household in case of power failure. *Secondary market* Research and development in nonrenewable or alternate source of energy applications. *Assumptions* New product platform *Stakeholders* 

Retailers and Common man



# <u>Batch – 16</u> <u>Glove Assistant</u>

### **Brief Introduction**:

The product glove assistant is provided communicate with pre-defined gestures and can be connected to a speaker and uniquely linked to a cell-phone for additional assistance.

The applications enables:

- Communication of the physically challenged (deaf & dumb) to a normal person and viceversa.
- Showing frequently asked questions in a locality in the smart phone thus saving the time.

### Major Components of the product development:

• <u>Software</u>:

The development of corresponding gesture recognition for communication, decoding of spoken words into a string.

The product incorporates an android phone, which, provides a user friendly interface to the customer.

The device uses machine learning algorithm(multi-label neural network) to adjust to the customer"s sign language practices.

### • Hardware:

The design of the gloves, speakers and a bluetooth module that can be in which can be uniquely detected by a touch screen device using a Audrino microcontroller. The microcontroller is used to receive the electronic input from the flex sensors in gloves. It processes the data for each particular gesture made.

Custom Flex sensors used determines the electronic output from the joints of the fingers by reading its pressure input.

Accelerometers are used for tilt sensing.

The idea so far has been to divide the group of six into two sub-groups, whereby one sub-group concentrates on the hardware part and the other sub-group concentrates on the software part of the product.

