PROJECT REPORT

ON

ìSMART AGRICULTUREò

Submitted in partial fulfilment of the requirements for the award of degree of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SUBMITTED BY:

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Under the Guidance of

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Department of Electronics and Communication Engineering

B.M.S COLLEGE OF ENGINEERING

(Autonomous College Affiliated to Visvesvaraya Technological University, Belgaum)

Bull Temple Road, Basavanagudi, Bangalore-560019

OLLEGE OF ENGINEERING

tonomous College under VTU)

Department of Electronics and Communication Engineering

CERTIFICATE

This is to certify that the project entitled **"SMART AGRICULTURE"** is a bonafide work carried out by **Hemantha Gowda C V** (USN:1BM11EC406), **Kaveen Kumar M K** (USN:1BM11EC408), **Nikhil D G** (USN:1BM11EC415) and **Prathap J** (USN:1BM11EC417) in partial fulfillment for the award of Bachelor of Engineering degree by VTU Belgaum, during the academic year 2013-2014.

Harish V Mekali Assistant Prof., ECE, BMSCE	**Dr. D .Seshachalam** HOD, ECE, BMSCE	**Dr. K.Mallikharjuna Babu** Principal, BMSCE

External Examination: **Signature with date:**

1.

2.

This work is dedicated to all the farmers of the nation

ABSTRACT

y marching towards a serious electric energy crisis, owing to an escalating desire of electric energy becoming greater than its supply. We have always failed to accept that the energy we make use of each day is restricted, yet taking it for granted. Coal, petroleum, electric power, even water has inadequate availability. Nevertheless, we have not taken sufficient precautions to handle a possible energy crisis. Another main concern has been the lifespan of guided media and its loopholes to intercept and eavesdrop.

Agricultural sector has maintained a dominant position on economy and as a natural supply for the country. Understanding the effects of heat and humidity, rain and erosion is the need of the day. Given the recent technological improvements the world has seen, failing to make use of it would be a sin on mankind. Here comes the need for a systematic hold on monitor of the data. As with the increase in technological innovations, so is the increase in required source power. An open minded effort would be to keep an eye on these available values from a remote location, interfacing a spot-on display, along with minimal power as possible.

CKNOWLEDGEMENT

cholastic or otherwise does not depend solely on the individual efforts but on the guidance, encouragement and cooperation of intellectuals, elders and friends. A number of personalities, in their own capacities have helped us in carrying out this project work. We would like to take this opportunity to thank them all.

We express profound gratitude to respected principal **Dr. K. Mallikharjuna Babu,** BMS College of Engineering for providing a congenial environment to work in.

Our sincere gratitude to **Dr. D. Seshachalam,** Head of the Department, Electronics and Communication Engineering for encouraging and providing this opportunity to carry out the project in the department.

We would like to thank our guide **Mr. Harish V. Mekali,** Assistant Professor, Department of ECE who helped us in all the ways to carry out the project work. He stood beside and guided us in every step.

Our heartfelt thanks to **Dr. K. R. Suresh**, Professor, Dept. of Civil Engineering, for providing valuable information regarding agriculture and funding the complete project

Our special thanks to **Dr. Sadanand Gulwadi**, University Relation Manager, ARM, for providing the ARM MBED Cortex-M0 boards around which project has been built.

We will be incomplete, if we don't mention our heartfelt thanks to **Mr. Ashrith,** 5th Sem, CSE, BMSCE for his expertise at Web Page development & the corresponding software parts**.**

We would like to share the joy completing the project to all the team members of NXP lab**.**

We thank all our professors for providing the basic knowledge without which this project wouldn't have been possible. Last but not the least we thank our family and friends, who made their valuable support compelled us to maintain a standard throughout our endeavour.

PONSOR DETAILS

We are very much thankful to Visvesvaraya Technological University for funding the entire project.

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Ref. No VTU / Aca. / 2011-12 / A-9 / 7[illegible] Date: 5 MAY 2012

B.M.S. COLLEGE OF ENGINEERING Acs Copy No. 97 MAY 2012 Date

B.M.S. COLLEGE OF ENGINEERING No. Ac109 Date 10/5/12 BANGALORE

To,
The Principal,
B M S College of Engineering,
BANGALORE

Sir,

Sub: Financial Assistance under VTU Research Grants Scheme for the Research project entitled "Advanced Irrigation Scheduling for Sustainable Development" submitted by Dr. K. R. Suresh - Principal Investigator reg..

Ref: 1. VTU/Aca./2010-11/A-9/14285 dated: 14-02-2011
2. E C Resolution No. 8.9, 98th Meeting of VTU, Belgaum dated: 29-10-2011

With reference to the above subject, the project proposal entitled "Advanced Irrigation Scheduling for Sustainable Development" submitted by Dr. K. R. Suresh - Principal Investigator, Department of Civil Engineering of your institution is sanctioned with a grant of ₹ 10.00 lakhs (Rupees Ten lakhs only) for a period of 2 years.

The details of grant for which the total allocation of ₹ 10.00 lakhs are as follows:

Expenditure details (Rs. in lakhs)	Year I	Year II	Total
Sensors and data acquisition system	09.70	--	**09.70**
Consumables - Soil, Manure, Seeds and Pest control	0.10	0.20	**0.30**
Total:	**09.80**	**0.20**	**10.00**

The sanction of the grant is subject to the following conditions:

1) The grant will be released in the name of the Principal of the institution.
2) The research activities will be evaluated by the evaluation committee constituted by VTU at the end of every year after commencement of the project, apart from periodic review.
3) The grant shall be utilized for the purpose for which it has been sanctioned. Mixing of heads of expenditure mentioned in the table is not allowed.
4) Funds for subsequent years shall be released on satisfactory progress and submission of half yearly Progress Report by the PI. Audited Statement of Accounts and Utilization Certificate

ABLE OF CONTENTS

TERATURE SURVEY

Using a Wireless Sensor Network and GPRS Moduleô, By - Gutierrez, J., Villa-Medina, J.F., Nieto-Garibay, A., Porta-Gandara M.A.

- Knowledge on the design mainly consisting of wireless sensor network and wireless information unit thatôs based on Zigbee technology and is realized using GPRS module and concentrated on low power consumption.
- Knowledge on achieving low power consumption using PIC.
- Knowledge on sensor network powered by solar panel with rechargeable battery that works for a longer time.
- Knowledge on UART interfaces with microcontroller that can accept the data with a speed of 115.2kbps from GPRS module.

2. óSmart Orchid Soil Moisture Monitoring System Based on Wireless Communication Technologyô By- Ye Na & Liu Junfeng.
   - Insight on the system cored with a Low-Power Microprocessor óMSP430f149 MCUô which employs smaller radiations to the environment and human body.
   - Insight on achieving a wide range of influence on soil moisture and intelligent control of data in a fixed memory.
   - Insight on achieving a 24hr uninterrupted monitoring.
   - Insight on serial non-volatile data memory chip for storage and display device, that is based on I2C bus, in turn using multifunctional memory chip of the ferroelectric technology which contains RTC.

3. óThe optimizing design and application of a new wireless Low-power universal data acquisition systemô By- Yan-fei ai1, yu-jie hao1, jian-ping li1.
   - Perspective on breakthrough of traditional network communication by employing multi interface design consisting of Zigbee terminal, Zigbee router, Zigbee coordinator.
   - Perspective on similar interface device connectivity with TI's chip TUSB3410 & integrated CS8900 Ethernet chip to support Ethernet interface to realize Ethernet communications; realizing serial port connectivity with PC.
   - Perspective on optimization of data communication by avoiding data conflicts using hexagon method.

INTRODUCTION

Agriculture uses 85% of available fresh water resources worldwide and this percentage will continue to be dominant in water consumption because of population growth and increased food demand. There is an urgent need to create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial and institutional improvements. For every 18 months the demand for electric based requirements increases two-fold.

The proposed project has been our brain child on such a low power DAS. We have proudly maintained a check on power requirement the without degrading the quality of it. This low power data acquisition system can be used in farm fields for acquiring the values of temperature and humidity using sensors.

1.1 WEATHER MONITORING SYSTEM

We would like to begin by introducing our head start, another similar important project **'WEATHER MONITORING SYSTEM'** by a fellow college mate Mr. Nithin whose work is based on monitoring the various factors of weather. We happily like to extend that this project has been successfully completed with the required outcomes matching his expectations.

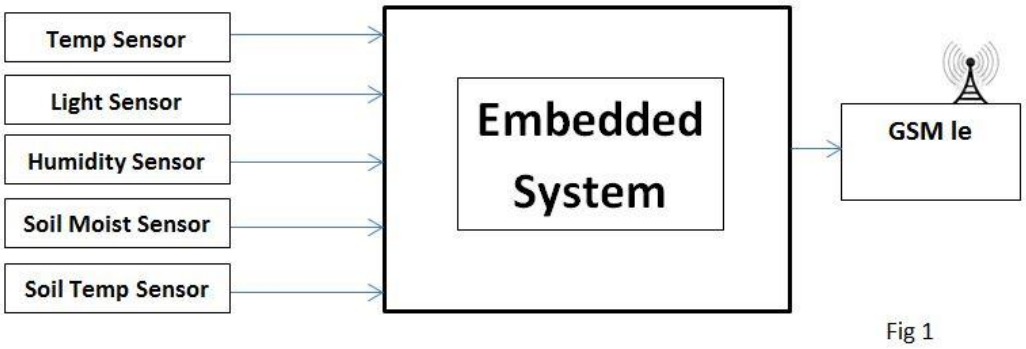


FIG 1.1(A): Depicts the transmitter part of the embedded system where the sensors read the values and sends them to a mobile phone in the form of SMS through GSM Module.

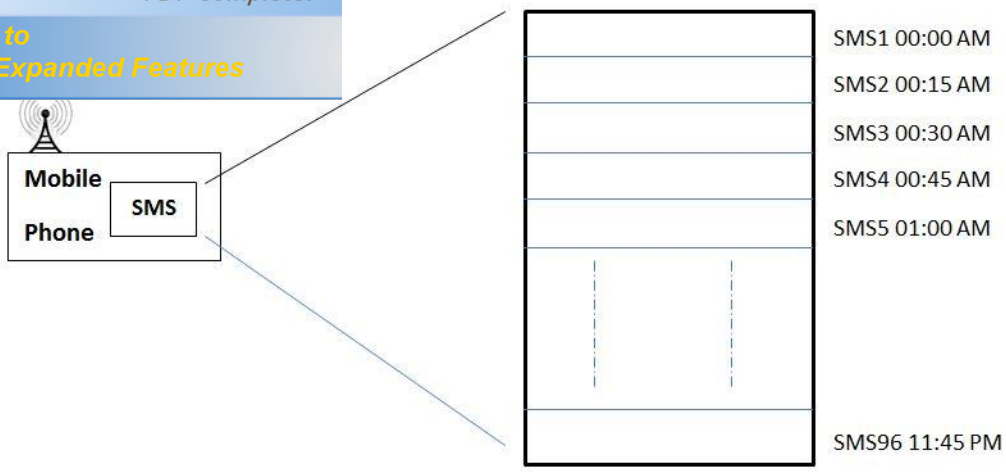


FIG 1.1(B): Receiver part of the embedded system where messages received for every 15 mins will be stacked in the mobile storage.

SMS Format will be as given below.

Temp:29°C
SM:25%
ST:18°C
Lum:100lu
x RH:20%

FIG 1.1(C): Output working where get the graph of the corresponding parameter as shown above.

The aim of the project is to get the graph of the required parameter values.

1.2 Proposed Problem

But the qualitative output comes at a cost of the power required. The power consumption is relevantly high to the expected working. In a single statement the problem can be pointed as

ñNo **'Data Acquisition System'** at a remote area is perfect unless it works at a considerably low power & extended battery life at least for a duration of year and more.ò

griculture" can be called as a successor of the above mentioned

As a sensible world resident, we begin by investigating alternative power solutions and advancement in technology, for example solar, wind electric energy and LDOs respectively. Utilizing these alternative energy solutions in as a whole is comparatively realistic and cheap to modern day units. Technical solutions, previously accomplished using Analog circuitry, have been converted into data acquisition systems that translate Analog input signals into digital information and process the binary data. With a few additional ideas to decrease the power consumption by employing solar cells and the improved features provided by ARM such as ó**Sleep Mode'** we lend a heavy help.

1.4 Implementation Model

Microcontroller: ARM Cortex M0 works as the heart of the project. It controls the output peripherals depending on the input sensor thresholds.

Sensors: Variety of sensors are used to detect the physical conditions of the environment such as moisture, temperature, humidity etc.

LCD Display: LCD 16x2 Display employed displays the various parameters of the sensors.

Solar Panel – Battery: The Solar panel helps in providing power by acquiring the energy from the Sunôs rays. This in-turn is fed to the battery employed for storage and future uses.

GSM: A GSM module is employed in the project such that the read values are not only displayed but also available online through the internet connection.

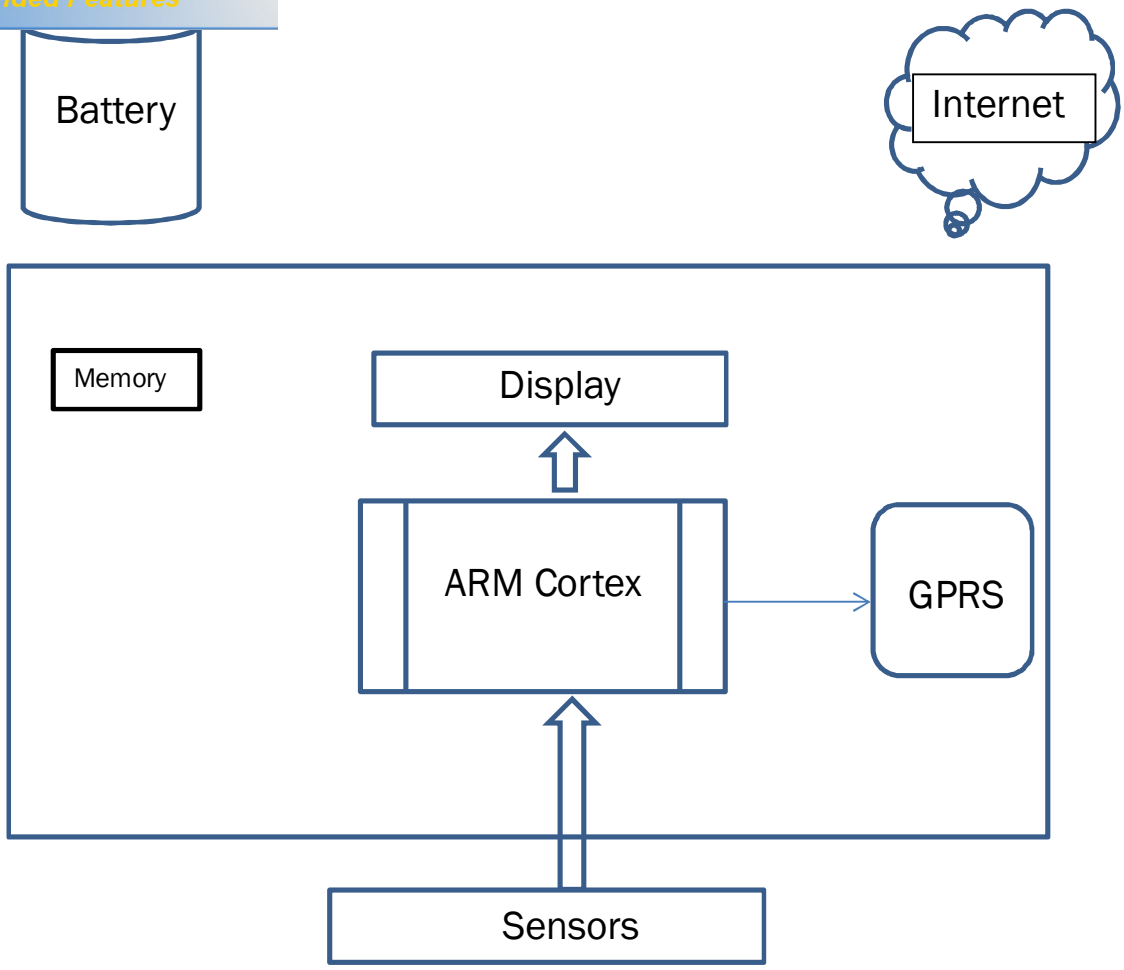


Fig. 1.5 Conceptual block diagram of the model

PROJECT FLOW

2.1 COMPONENTS USED

- ARM CORTEX M0 LPC11U24
- LCD 16x2 DISPLAY
- PC817 OPTO-COUPLER
- SIM900 GSM MODULE
- DC-12V RELAY
- MOISTURE SENSOR

2.2 HARDWARES:

2.2.1 ARM CORTEX M0 LPC11U24:

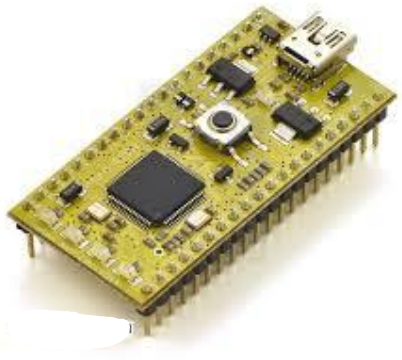


FIG. 2.2.1 ARM Cortex-M0

2.2.2 General description

- The LPC11U2x are an ARM Cortex-M0 based, low-cost 32-bit MCU family, designed for 8/16-bit microcontroller applications, offering performance, low power, simple instruction set and memory addressing together with reduced code size compared to existing 8/16-bit architectures.

- The LPC11U2x operate at CPU frequencies of up to 50 MHz

- Equipped with a highly flexible and configurable full -Speed USB 2.0 device controller, the LPC11U2x brings unparalleled design flexibility and seamless integration to todayôs demanding connectivity solutions.

nt of the LPC11U2x includes up to 32 kB of flash memory, up to mory and 4 kB EEPROM, one Fast -mode Plus I^2C-bus interface, one RS-485/EIA-485 USART with support for synchronous mode and smart card interface, two SSP interfaces, four general- purpose counter/timers, a 10-bit ADC (Analogy-to-Digital Converter), and up to 54 general-purpose I/O pins.

2.3 Features and benefits

2.3.1 System:

- ARM Cortex-M0 processor, running at frequencies of up to 50 MHz
- ARM Cortex-M0 built-in Nested Vectored Interrupt Controller (NVIC).
- Non-Maskable Interrupt (NMI) input selectable from several input sources.
- System tick timer.

2.3.2 Memory:

- Up to 32 kB on-chip flash program memory.
- Up to 4 kB on-chip EEPROM data memory; byte erasable and byte programmable.
- Up to 10 kB SRAM data memory.
- 16 kB boot ROM.
- In-System Programming (ISP) and In-Application Programming (IAP) for flash and EEPROM via on-chip bootloader software.
- ROM-based USB drivers. Flash updates via USB supported.
- ROM-based 32-bit integer division routines.

2.3.3 Debug options:

- Standard JTAG (Joint Test Action Group) test interface for BSDL (Boundary Scan Description Language).
- Serial Wire Debug.

2.3.6 Serial interfaces:

- USB 2.0 full-speed device controller.
- USART (Universal Synchronous Asynchronous Receiver/Transmitter) with fractional baud rate generation, internal FIFO, a full modem control handshake interface, and support for RS-485/9-bit mode and synchronous mode. USART supports an asynchronous smart card interface (ISO 7816-3).
- Two SSP (Synchronous Serial Port) controllers with FIFO and multi-protocol capabilities.
- I^2C-bus interface supporting the full I^2C-bus specification and Fast-mode Plus with a data rate of up to 1 Mbit/s with multiple address recognition and monitor mode.

2.3.5 Analog peripherals:

nput multiplexing among eight pins.

ls:

I/O (GPIO) pins with configurable pull-up/pull-down resistors, repeater mode, and open-drain mode.

- Up to 8 GPIO pins can be selected as edge and level sensitive interrupt sources.
- Two GPIO grouped interrupt modules enable an interrupt based on a programmable pattern of input states of a group of GPIO pins.
- High-current source output driver (20 mA) on one pin.
- High-current sink driver (20 mA) on true open-drain pins.
- Four general-purpose counter/timers with a total of up to 5 capture inputs and 13 match outputs.
- Programmable Windowed WatchDog Timer (WWDT) with a dedicated, internal low-power WatchDog Oscillator (WDO)

2.3.7 Clock generation:

- Crystal Oscillator with an operating range of 1 MHz to 25 MHz (system oscillator).
- 12 MHz high-frequency Internal RC oscillator (IRC) that can optionally be used as a system clock.
- Internal low-power, low-frequency WatchDog Oscillator (WDO) with programmable frequency output.
- PLL allows CPU operation up to the maximum CPU rate with the system oscillator or the IRC as clock sources.
- A second, dedicated PLL is provided for USB.
- Clock output function with divider that can reflect the crystal oscillator, the main clock, the IRC, or the watchdog oscillator.

2.3.8 Power control:

- Integrated PMU (Power Management Unit) to minimize power consumption during Sleep, Deep-sleep, Power-down, and Deep power-down modes.
- Power profiles residing in boot ROM provide optimized performance and minimized power consumption for any given application through one simple function call.
- Four reduced power modes: Sleep, Deep-sleep, Power-down, and Deep power-down.
- Processor wake-up from Deep-sleep and Power-down modes via reset, selectable GPIO pins, watchdog interrupt, or USB port activity.
- Processor wake-up from Deep power-down mode using one special function pin.
- Power-On Reset (POR).
- Brownout detects with four separate thresholds for interrupt and forced reset.
- Unique device serial number for identification.
- Single 3.3 V power supply (1.8 V to 3.6 V).
- Temperature range 40 C to +85 C.
- Available as LQFP64, LQFP48, TFBGA48, and HVQFN33 packages.

- Medical
- Consumer peripherals
- USB Audio devices
- Industrial control

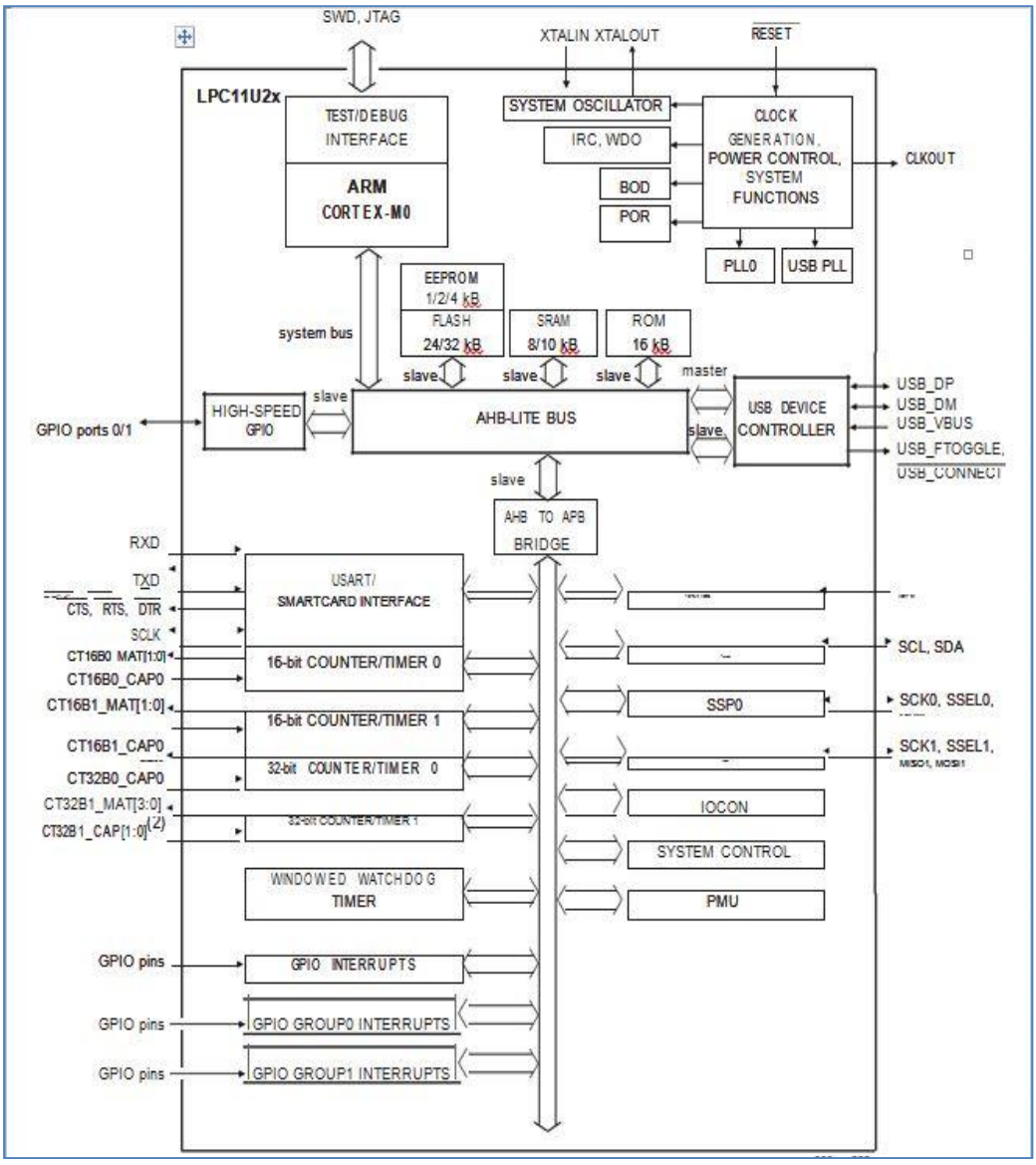
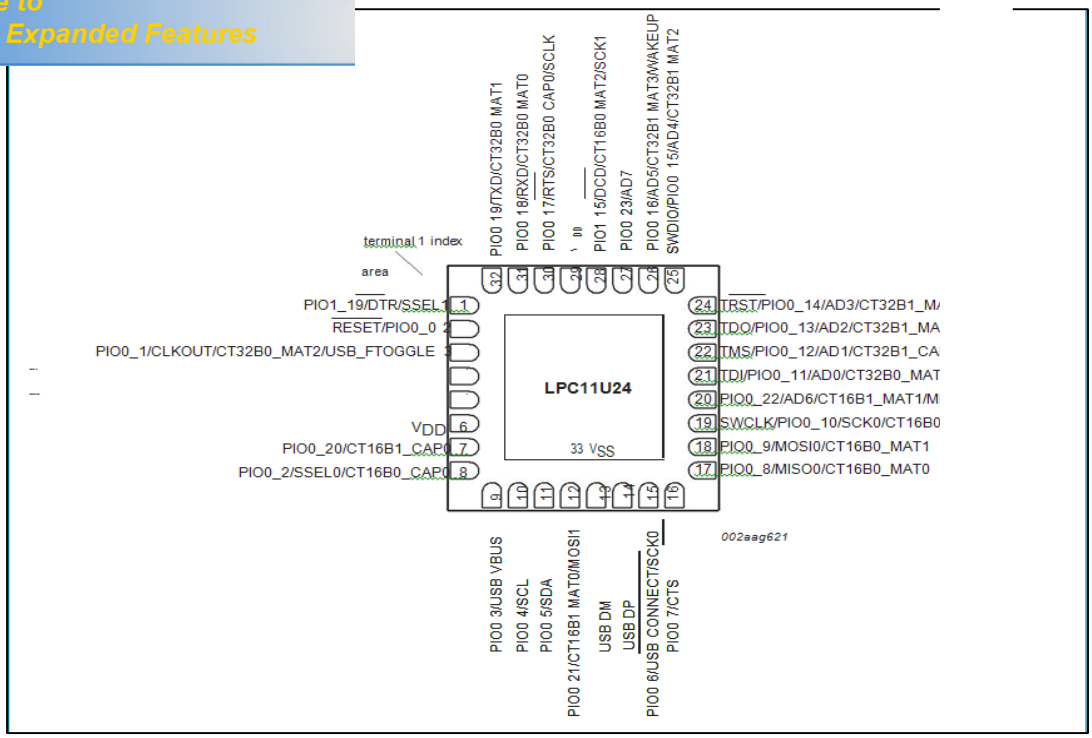


FIG. 2.4(A) ARM CORTEX M0 ARCHITECHTURE



2.4(B) TOP VIEW OF CORTEX M0

2.4 LCD 16x2 DISPLAY

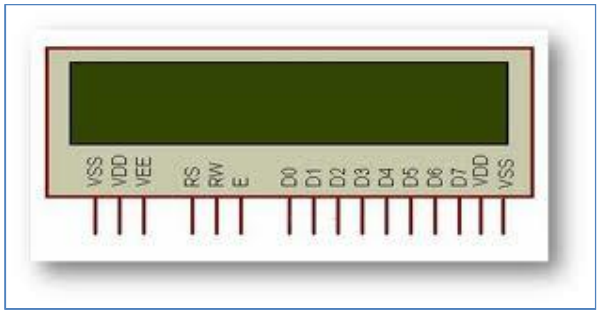


FIG. 2.4 LCD 16X2 DISPLAY

LCD (Liquid Crystal Display): A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments) animations and so on.

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

the command instructions given to the LCD. A command is an edefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

2.4.1 Pin Description:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V ï 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

TABLE 2.4.1 PIN DESCRIPTION OF LCD 16X2 DISPLAY

R:

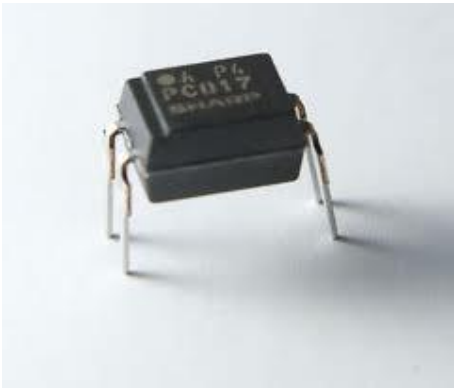


FIG. 2.5(A) OPTO-COUPLER IC

The HCPL-817 contains a light emitting diode optically coupled to a phototransistor. It is packaged in a 4-pin DIP package and available in wide-lead spacing option and lead bend SMD option. Input-output isolation voltage is 5000 Vrms. Response time, tr, is typically 4 µs and minimum CTR is 50% at input current of 5 mA.

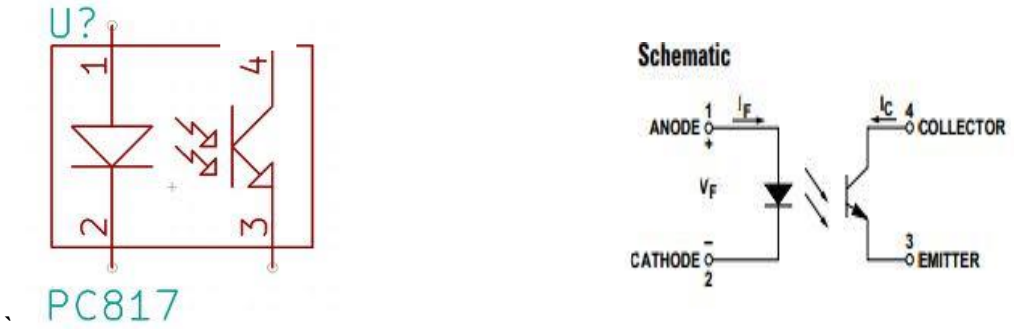


FIG. 2.5(B) INTERNAL CONNECTION AND SCHEMATIC OF OPTO-COUPLER IC PC817

ODULE:

You need only two wires (TX, RX) except Power supply to interface with microcontroller / Arduino. The built in Power supply allows you to connect wide range unregulated power supply. Using this modem, you can send SMS, data and read SMS through simple AT command.

FIG. 2.6 SIM900 GSM MODULE

This is a complete Quad-band GSM/GPRS module in a SMT type and designed with a very powerful single-chip processor integrating AMR926EJ-S core, allowing you to benefit from small dimensions and cost-effective solutions.

Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900 can fit almost all the space requirements in your M2M applications, especially for slim and compact demands of design.

* Quad-Band 850/ 900/ 1800/ 1900 MHz
* GPRS multi-slot class 10/8
* GPRS mobile station class B
* Compliant to GSM phase 2/2+
  - ï Class 4 (2 W @850/ 900 MHz)
  - ï Class 1 (1 W @ 1800/1900MHz)
* Dimensions: 24*24*3mm
* Weight: 3.4g
* Control via AT commands (GSM 07.07 ,07.05 and SIMCOM enhanced AT Commands)
* SIM application toolkit
* Supply voltage range : 3.2 ... 4.8V
* Low power consumption: 1.0mA(sleep mode)
* Operation temperature: -40°C to +85 °C

2.6.2 Specifications for SMS via GSM/GPRS:

* Point to point MO and MT
* SMS cell broadcast
* Text and PDU mode

2.6.3 Software features:

* 0710 MUX protocol
* embedded TCP/UDP protocol
* FTP/HTTP

2.6.4 Special firmware:

* FOTA
* MMS
* **Java (cooperate with Isolation)**
* Embedded AT

.7 DC-12V RELAY:

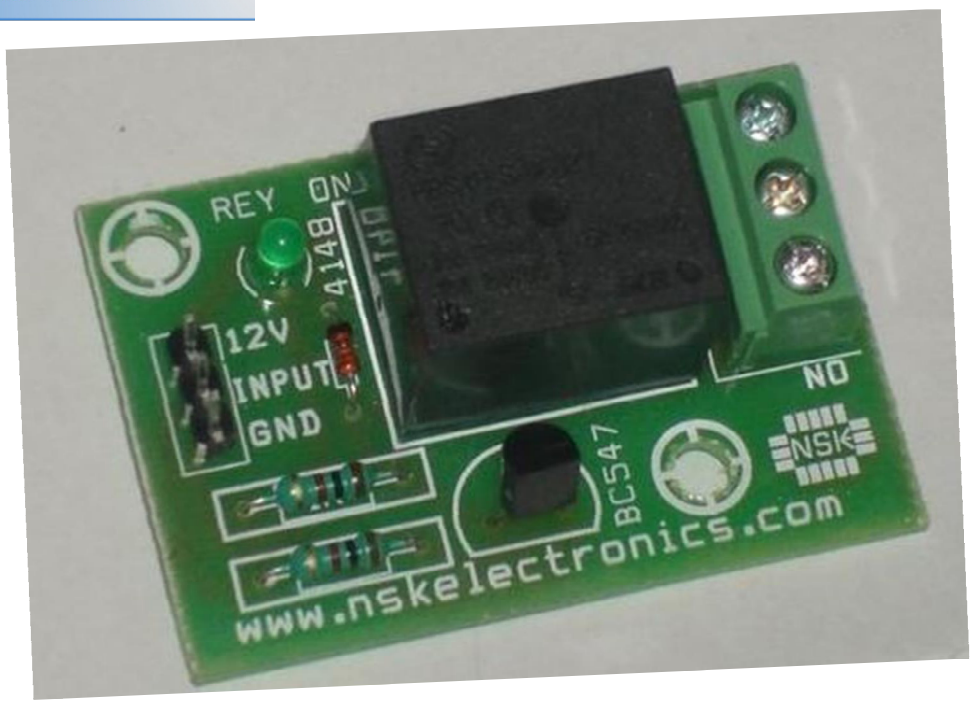


FIG. 2.7 RELAY

A relay is an electrical switch that uses an electromagnet to move the switch from the off to on position instead of a person moving the switch. It takes a relatively small amount of power to turn on a relay but the relay can control something that draws much more power.

2.7.1 OPERATION OF RELAY:

Relays (and switches) come in different configurations. The most common are shown to the right. Single Pole Single Throw (SPST) is the simplest with only two contacts. Single Pole Double Throw (SPDT) has three contacts. The contacts are usually labelled Common (COM), Normally Open (NO), and Normally Closed (NC). The Normally Closed contact will be connected to the Common contact when no power is applied to the coil. The Normally Open contact will be open (i.e. not connected) when no power is applied to the coil. When the coil is energized the Common is connected to the Normally Open contact and the Normally Closed contact is left floating. The Double Pole versions are the same as the Single Pole version except there are two switches that open and close together. Select a relay with contacts that can handle the voltage and current requirements of the load. Keep in mind that some loads (such as motors) draw much more current when first turned on than they do at steady state. Select a relay with a coil voltage and current that you can control easily. Ex: If you want to turn on the AC unit with a 12VDC power supply get a 12VDC coil. Note: Coils will be rated for either AC or DC.

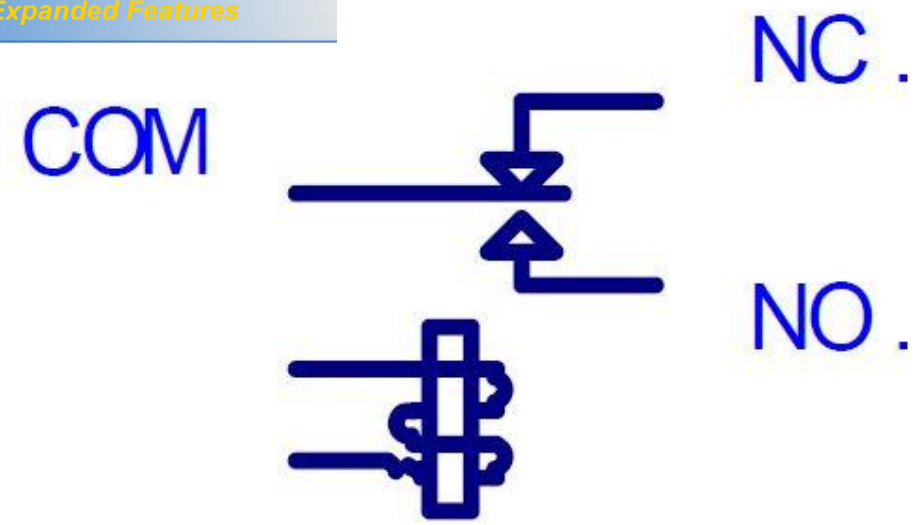


FIG. 2.7.1 RELAY OPERATION

2.7.2 The primary functions of a relay are:

- The galvanic separation of the primary or actuating circuit and the load circuits
- Single input/multiple output capability
- Separation of different load circuits for multi-pole relays
- Separation of AC and DC circuits
- Interface between electronic and power circuits
- Multiple switching functions, e.g. delay, signal conditioning
- Amplifier function.

2.7.3 Applications of Relay:

Typical applications for relays include laboratory instruments, telecommunication systems, computer interfaces, domestic appliances, air conditioning and heating, automotive electrics, traffic control, lighting control, building control, electric power control, business machines, control of motors and solenoids, tooling machines, production and test equipment.

FIG 2.8 VH400 MOISTURE SENSOR

2.8.1 Moisture Sensor:

High frequency VH400 series soil moisture sensor probes enable precise low cost monitoring of soil water content. Because our probe measures the dielectric constant of the soil using transmission line techniques, it is insensitive to water salinity, and will not corrode over time as does conductivity based probes. Our probes are small, rugged, and low power.

Compared to other low cost sensor such as gypsum block sensors, our probes offer a rapid response time. They can be inserted and take an accurate reading in under 1 second.

The VH400 operates at a much higher frequency and it is much more sensitive at higher VWC levels, and its curves are more linear.

Probes come standard with a 2 meter cable.

or Probe Applications:

- Irrigation and sprinkler systems.
- Moisture monitoring of bulk foods.
- Rain and weather monitoring.
- Environmental monitoring.
- Water conservation applications.
- Fluid level measurements.

2.8.3 Soil Moisture Sensor Probe Features:

- Extreme low cost with volume pricing.
- Not conductivity based.
- Insensitive to salinity.
- Probe does not corrode over time.
- Rugged design for long term use.
- Small size.
- Consumes less than 600uA for very low power operation.
- Precise measurement.
- Measures volumetric water content (VWC) or gravimetric water content (GWC).
- Patent pending technology.
- Output Voltage is proportional to moisture level.
- Wide supply voltage range.
- Can be buried and is water proof.
- Probe is long and slender for wider use, including smaller potted plants.

TESTING

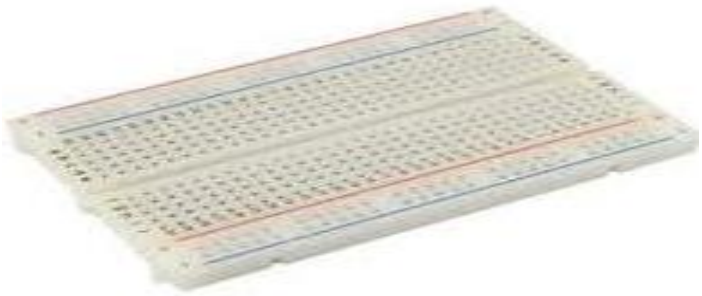


FIG 3.0 GENERAL REPRESENTATION OF A BREAD-BOARD

We initiated our idea on a General Bread-Board at the beginning. Our academics helped us to understand the basic model of a bread-board such that the connections upon it can be carried on with ease. Understanding of the internal connections is an important aspect with respect to the connections made upon it.

The overall project was carried forward by mounting the corresponding components on the Bread-Board as per the schematic.

3.1 ARM CORTEX M0:

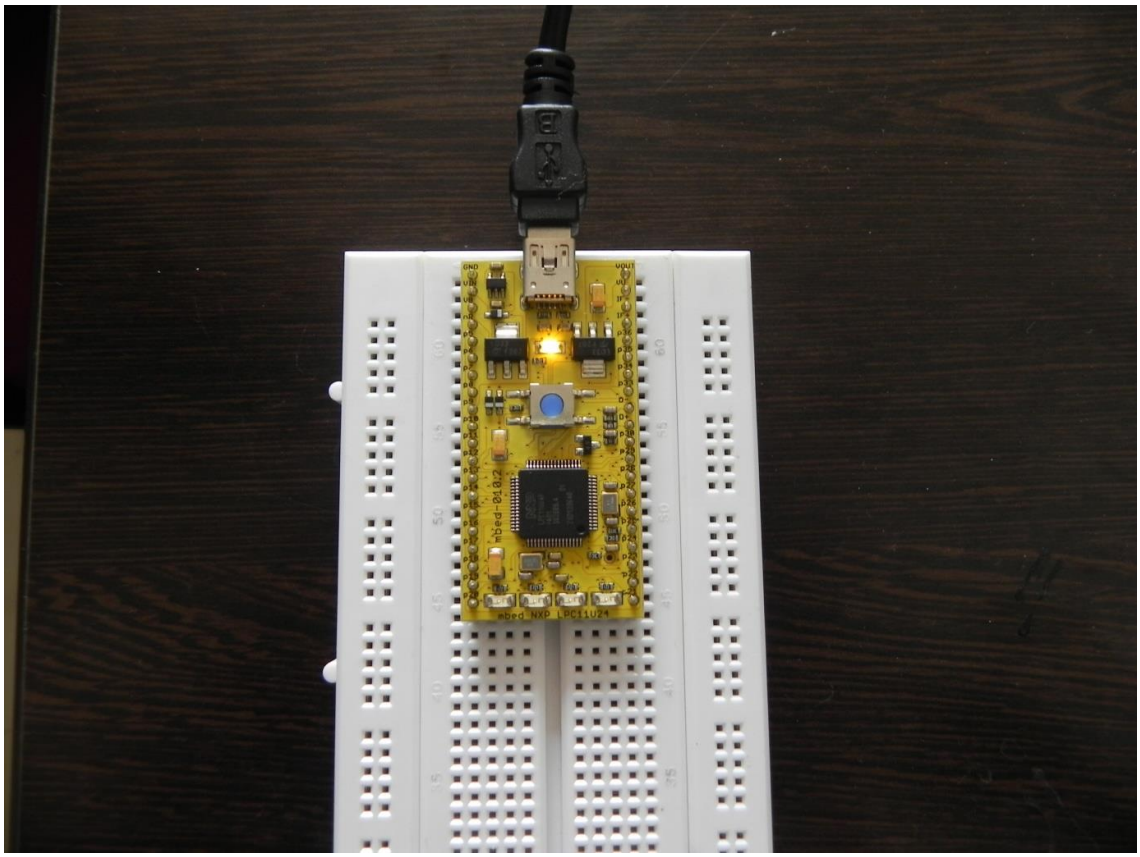


FIG 3.1 AN ARM IC ON A BREAD BOARD

main component that we wished to test first by embedding it on facing of USB connector. It was tested by using our knowledge of the online compiler.

The purpose to use ARM Cortex- M0 is because of the fact that it is the lowest power consuming IC available from the family of ARM Controllers.

3.2 LCD DISPLAY:

FIG. 3.2 LCD 16X2 DISPLAY

The next step of our testing was occupied by the output device ôLCD 16x2 Displayõ. We found it more important to display our outcomes through a device that can be more of an understanding to the outward world.

We even went to the extent of displaying our names quite naively.

3.3 Opto-coupler and Relay:

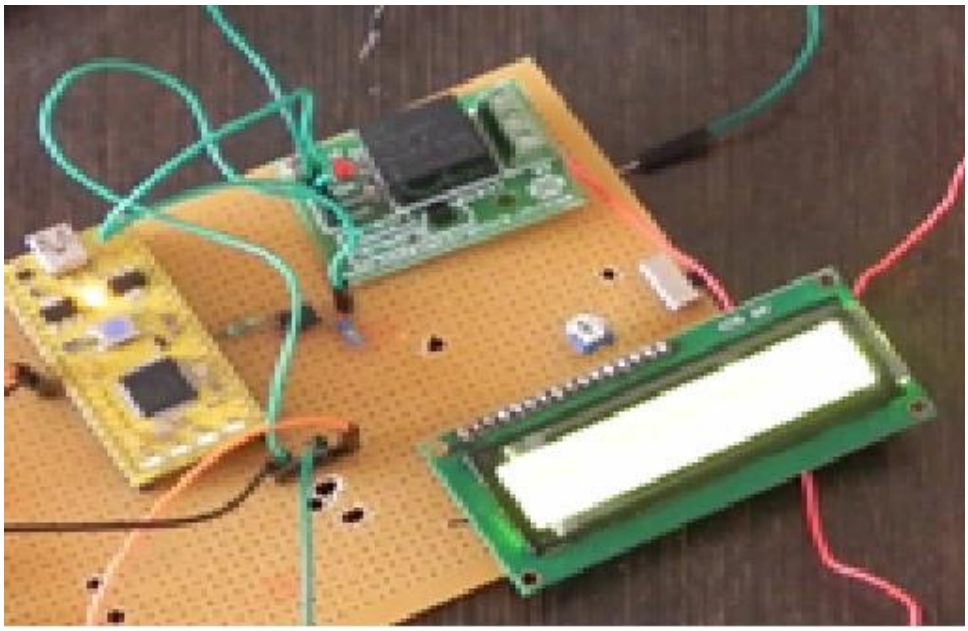


FIG 3.3 CONNECTION OF OPTO-COUPLER AND RELAY

ycle next by an opto-coupler. We followed it up with a relay to reason for using this opto-coupler was to provide isolation between the relay and the controller on one side. Also when the solenoid valve turns on it produces a back-emf which may turn out to be harmful to the controller. So in order to provide this very required isolation we employed the opto-coupler.

3.4 Sensors:

Our need was fed by the values from the sensors that we employed. The moisture sensor was used to sense the moisture level of the soil which was inturn fed to the controller. We set a calibrating threshold as per our required level. The programming was such that when the sensor value exceeded the threshold the controller provided the control signal to turn off the solenoid valve.

3.5 Final Working Model:

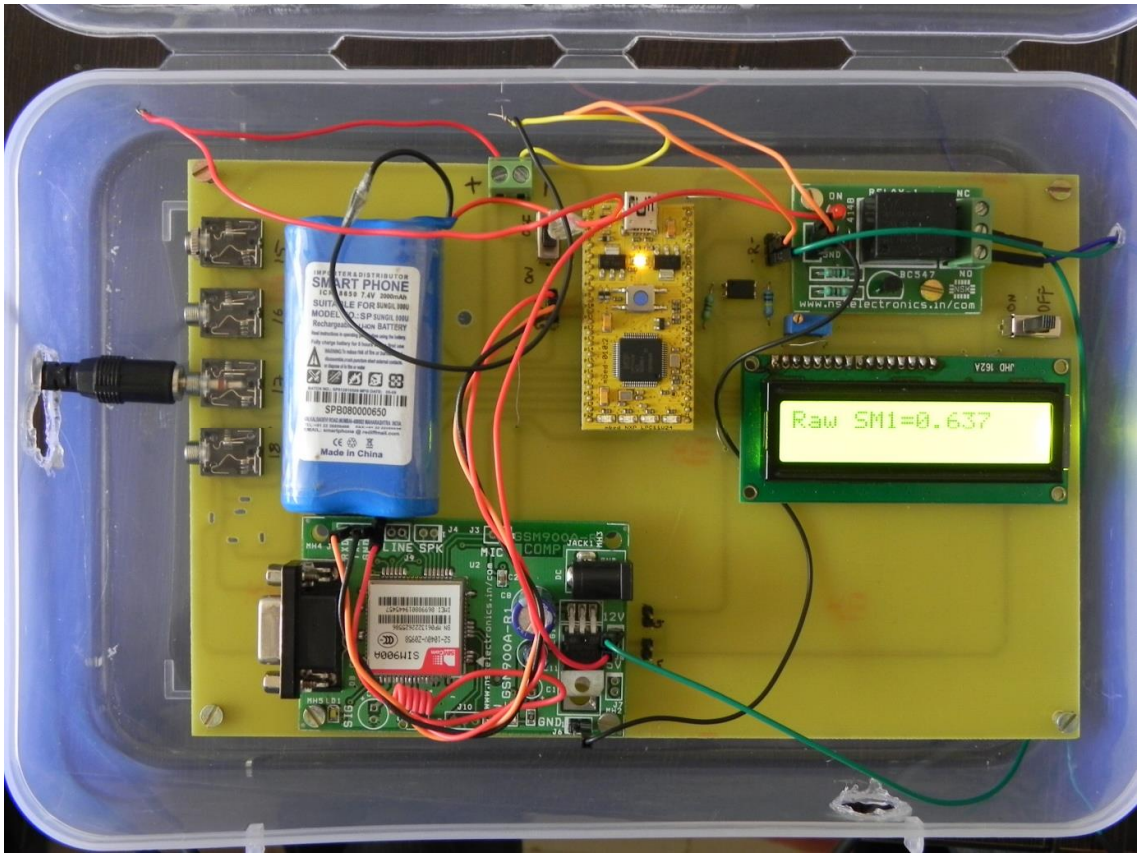


FIG 3.5 FINAL WORKING MODULE ON A PCB

1. System Software

Sl.No	Components	Reason for selection	Approx. cost
1.	Windows XP/7 OS	Experienced usage	-

2. Programming/Coding software

Sl.No	Components	Reason for selection	Approx. cost
1	Mbed online compiler	C++ coding for ARM MBED board	-
2	PHP Programming language	Basic web-page language	-

3. Application Software

Sl.No	Components	Reason for selection	Approx. cost
1.	Eagle layout editor 6.5.0	PCB design	-
2	HyperTerminal	Interfacing external modules to computer(PC/Laptop)	-

FIG 3.5 TABLES OF SOFTWARE USED

3.7 Software Layout:

On the other hand simultaneously we developed a model of the project on the PC as a soft format using ôEagle 6.5.0ô. Though none of us was an expert on the field we managed to learn it and create a schematic and board layout.

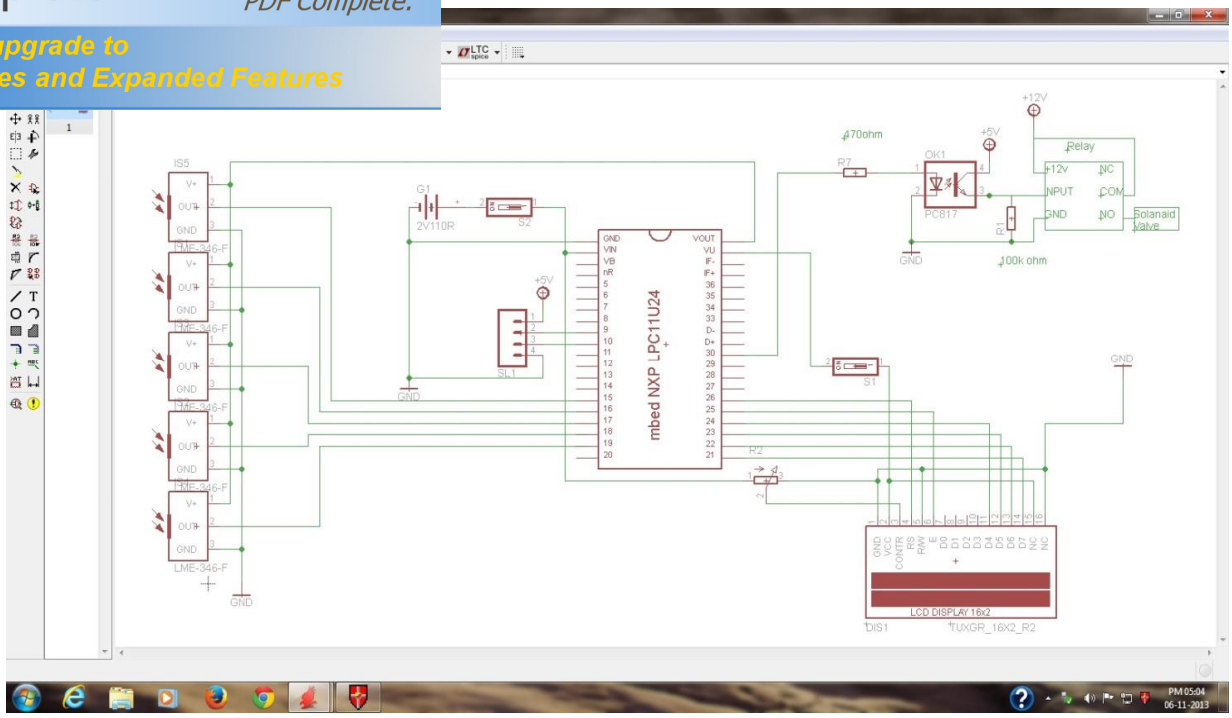


FIG. 3.7(A) FRONT VIEW OF PCB LAYOUT

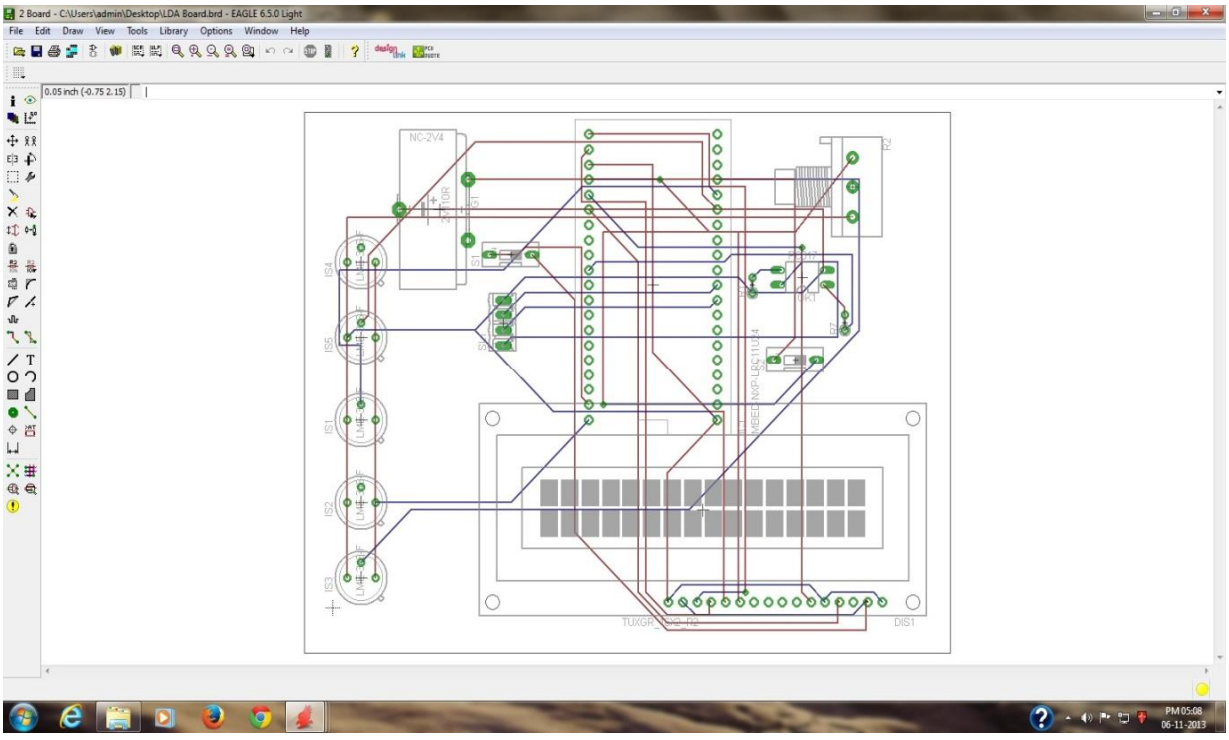


FIG 3.7(B) REAR VIEW

ACQUISITION:

We provide an alternate method of interfacing the output not just with a display but also uploading the parameters to the internet through a GSM Module. Any user in need of knowing the information can log-in with his identity & a distinct secure password and can obtain it.

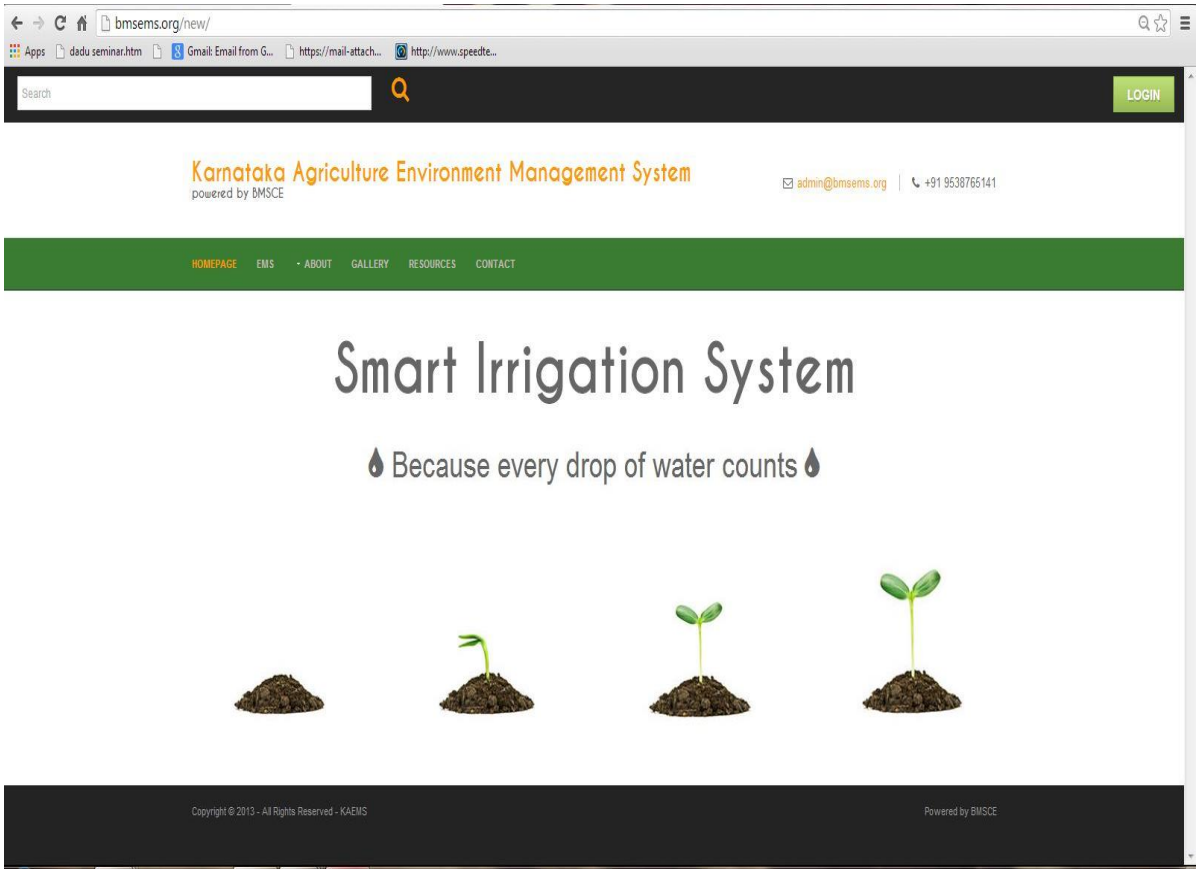


FIG 3.8(A) HOMEPAGE OF THE WEBSITE

The web-link is: **http://bmsems.org/new**

FIG 3.8(B) LOG-IN PAGE

Each user is provided with his own distinct ID & a secret password through which he can access the required data.

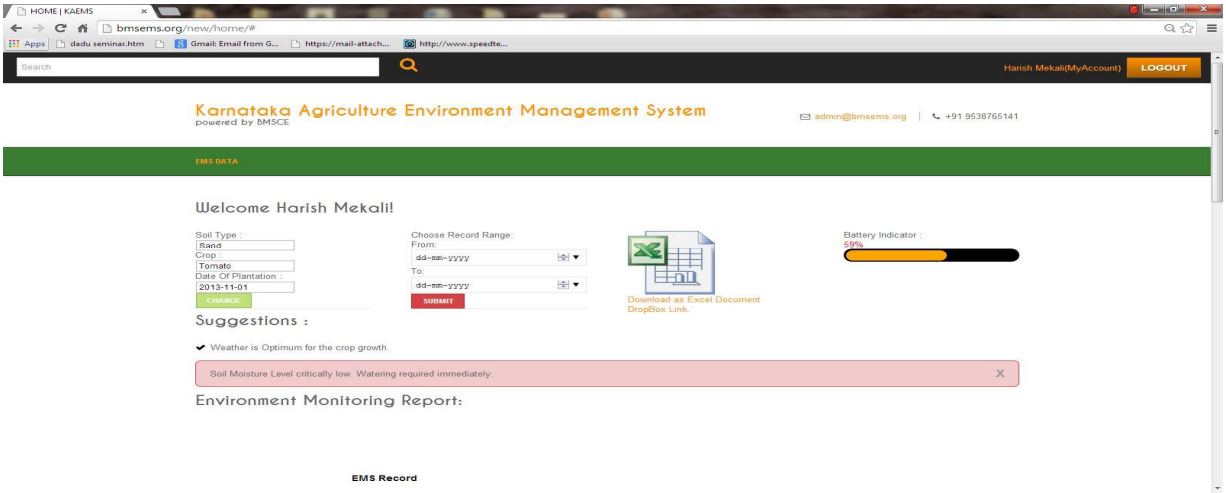


FIG. 3.8(C) USER WELCOME PAGE

The user has to login to the website as a member to access the data or use the website to read the parameter he wishes to get a hold on. For this he has to obtain the permission from the administrator.

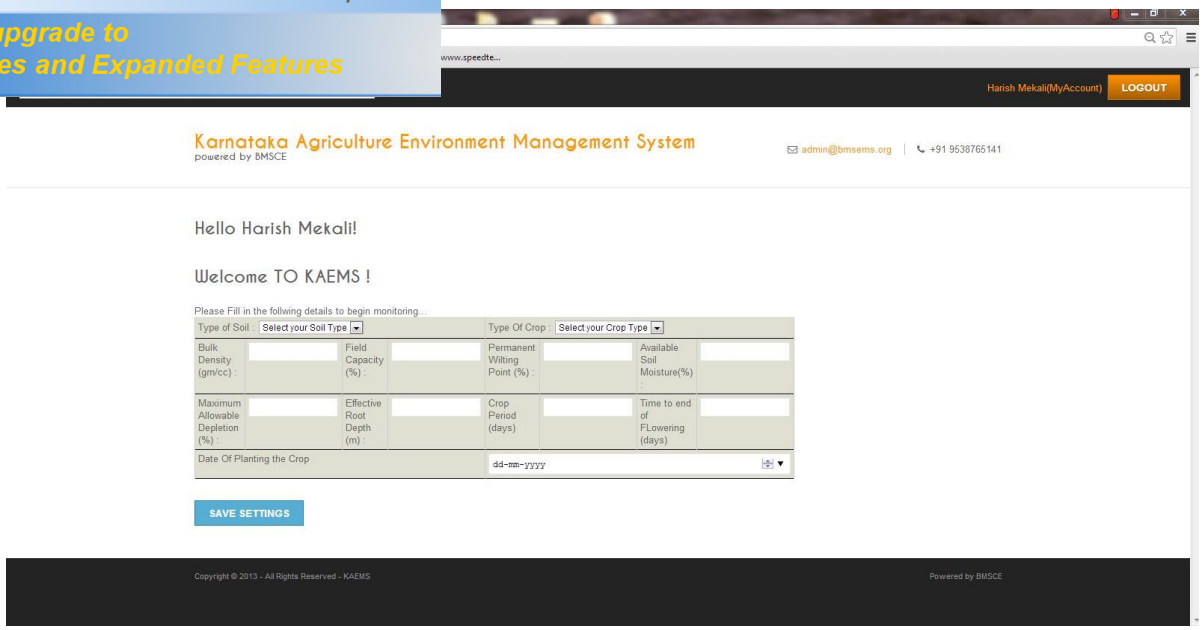


FIG 3.8(D) WEBPAGE OF THE CROP DETAILS

Initially we enter the information about soil type, crop and the date of plantation. This information is automatically updated to the database and based on this information our device controls the situation.

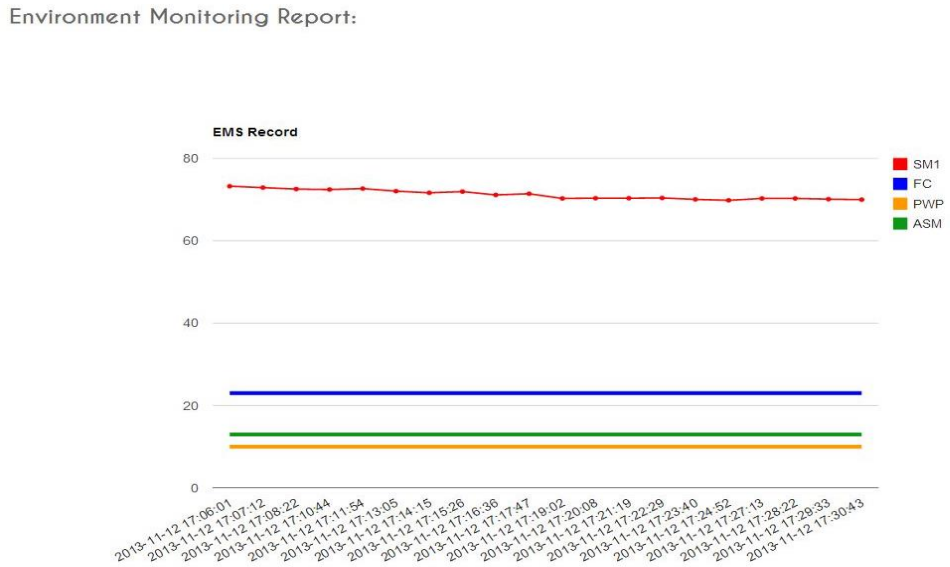
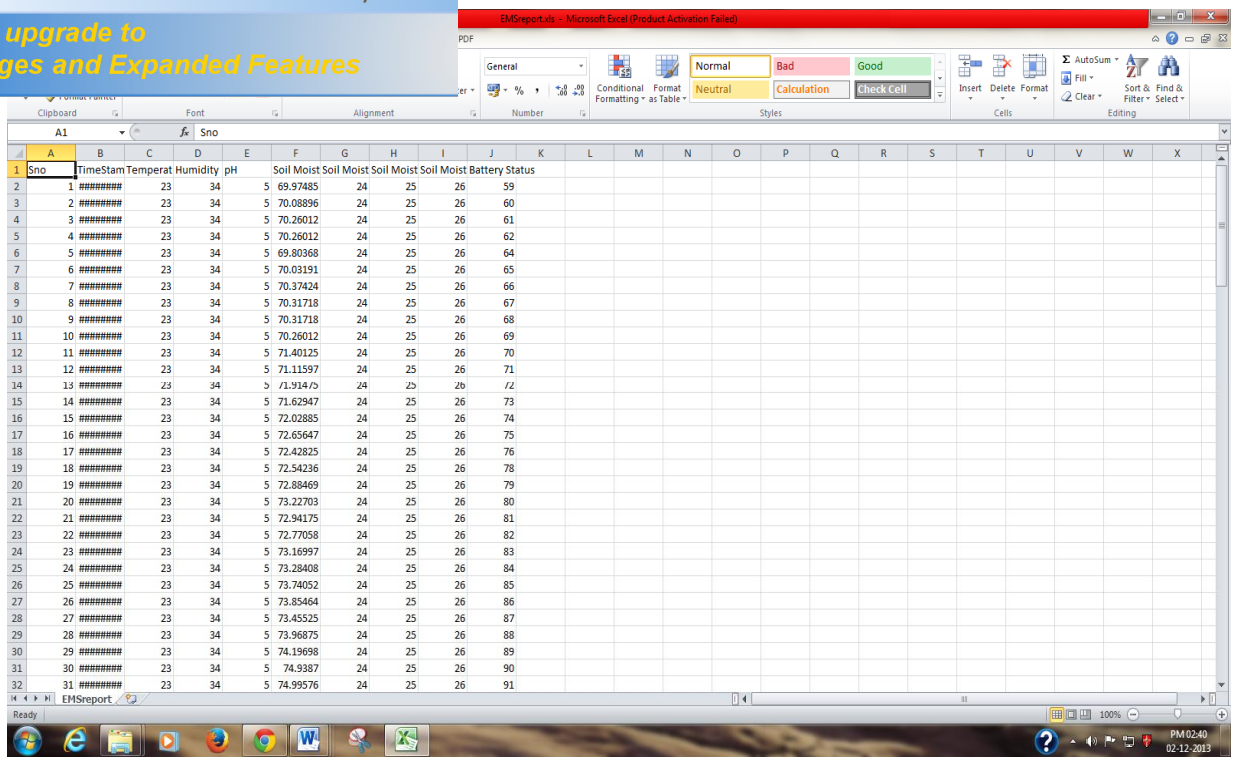


FIG 3.8(E) GRAPH

A graph displays the various sensor values employed, in detail and the output crop details along with the current battery percentage remaining.



Sno	TimeStam	Temperat	Humidity	pH	Soil Moist	Soil Moist	Soil Moist	Soil Moist	Battery Status
1	########	23	34	5	69.97485	24	25	26	59
2	########	23	34	5	70.08896	24	25	26	60
3	########	23	34	5	70.26012	24	25	26	61
4	########	23	34	5	70.26012	24	25	26	62
5	########	23	34	5	69.80368	24	25	26	64
6	########	23	34	5	70.03191	24	25	26	65
7	########	23	34	5	70.37424	24	25	26	66
8	########	23	34	5	70.31718	24	25	26	67
9	########	23	34	5	70.31718	24	25	26	68
10	########	23	34	5	70.26012	24	25	26	69
11	########	23	34	5	71.40125	24	25	26	70
12	########	23	34	5	71.11597	24	25	26	71
13	########	23	34	5	71.91475	24	25	26	72
14	########	23	34	5	71.62947	24	25	26	73
15	########	23	34	5	72.02885	24	25	26	74
16	########	23	34	5	72.65647	24	25	26	75
17	########	23	34	5	72.42825	24	25	26	76
18	########	23	34	5	72.54236	24	25	26	78
19	########	23	34	5	72.88469	24	25	26	79
20	########	23	34	5	73.22703	24	25	26	80
21	########	23	34	5	72.94175	24	25	26	81
22	########	23	34	5	72.77058	24	25	26	82
23	########	23	34	5	73.16997	24	25	26	83
24	########	23	34	5	73.28408	24	25	26	84
25	########	23	34	5	73.74052	24	25	26	85
26	########	23	34	5	73.85464	24	25	26	86
27	########	23	34	5	73.45525	24	25	26	87
28	########	23	34	5	73.96875	24	25	26	88
29	########	23	34	5	74.19698	24	25	26	89
30	########	23	34	5	74.9387	24	25	26	90
31	########	23	34	5	74.99576	24	25	26	91

FIG. 3.8(F) DETAILS ON AN EXCEL SPREADSHEET

The various sensor data are collectively stored in an excel sheet which can be used later to analyse. The excel files are maintained in an archive format so that less capacity holds maximum amount of information.

CONCLUSION

We proudly propose this idea to enhance the well-being of the farmers who reside at remote places and yet obtain the knowledge of their fields and crop information. This upgradement of Data Acquisition model to Low power Data Acquisition model greatly improves the power integrity affordable by the Indian agricultural farmers. We feel glad to conclude that we have touched an effort of few technological fields, sensible utilization of water, making use of modern wireless communication such as GSM & GPRS to name a few.

Developed system proves to be best for prototype but, still some work has to be done on product development as mentioned in future work.

Each student contributed his best with the amount of technical knowledge that he possessed combined with his passion to learn further and working innovatively by participating in the project actively.

We firmly believe that our report gives you a fair idea on the project and any suggestions be it on any of the section, we happily accept feedbacks and criticism.

FUTURE WORK

As in the conclusion where we did mention our inspiration to be the Weather Monitoring system (WMS) which was used as a single application in our project to monitor the soil moisture in the field along with detecting the temperature of an unknown land.

We all know that India is over-dependent on the limited power that is generated and borrowed from adjacent states. We would further like to improve our project by prioritizing at areas such as power consumption which currently feeds on battery to employing a solar cell that can power the system as well as store power for future requirements. We

Once again we would like to calibrate the available moisture sensor to design our own sensor, and to make a mesh network using Zigbees so that all the units communicate with each other, send the data through the main central unit to remote place.

By completing the remaining work, the next process of this work is to send the data to the server which can be accessed through the World Wide Web as an application. Be it Android, iOS or windows platform developing a project oriented application is just few steps of passion and hard work. Monitoring battery life for present PCB module, then to improve the battery life of the system, finally implement it in real time in the field for experiment.

ECOGNITION

on a few and looking forwards to are:

- 2nd runner up in the ARM Symposium held at Le Meridian, Bangalore in the year 2013.

(ARM COMPETETORS, GUIDES & DELIGATES)

BLIOGRAPHY

1. óAutomated Irrigation System Using a Wireless Sensor Network and GPRS Moduleô
By - Gutierrez, J., Villa-Medina, J.F., Nieto-Garibay, A., Porta-Gandara M.A.

2. óSmart Orchid Soil Moisture Monitoring System Based on Wireless Communication Technologyô
By- Ye Na & Liu Junfeng.

3. óThe optimizing design and application of a new wireless Low-power universal data acquisition systemô, By- Yan-fei ai1, yu-jie hao1, jian-ping li1

4. óWeather Monitoring Systemô, Project report ï 2013 batch

ANNEXURE

17-

Agilent HCPL-817

Phototransistor Optocoupler

High Density Mounting Type

Data Sheet

Description

The HCPL-817 contains a light emitting diode optically coupled to a phototransistor. It is packaged in a 4-pin DIP package and available in wide-lead spacing option and lead bend SMD option. Input-output isolation voltage is 5000 Vrms. Response time, t_r, is typically 4 µs and minimum CTR is 50% at input current of 5 mA.

Ordering Information

Specify part number followed by Option Number (if desired).

HCPL-817-XXX
└ Option Number

060 = VDE0884 Option
W00 = 0.4" Lead Spacing Option
300 = Lead Bend SMD Option
500 = Tape and Reel Packaging Option
00A = Rank Mark A
00B = Rank Mark B
00C = Rank Mark C
00D = Rank Mark D
00L = Rank Mark L

Features

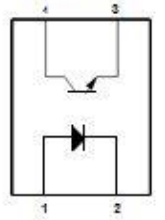
- Current Transfer Ratio (CTR: min. 50% at IF = 5 mA, VCE = 5 V)
- High input-output isolation voltage (Viso = 5000 Vrms)
- Response time (t_r: typ., 4 µs at VCE = 2 V, I_C = 2 mA, R_L = 100 Ω)
- Compact dual-in-line package
- UL approved
- CSA approved
- VDE approved
- Options available:
  - Leads with 0.4" (10.16 mm) spacing (W00)
  - Leads bends for surface mounting (300)
  - Tape and reel for SMD (500)
  - VDE 0884 approvals (060)

Applications

- Signal transmission between circuits of different potentials and impedances
- I/O interfaces for computers
- Feedback circuit in power supply

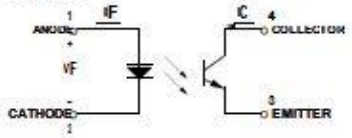
Functional Diagram

PIN NO. AND INTERNAL CONNECTION DIAGRAM



1. ANODE 3. EMITTER
2. CATHODE 4. COLLECTOR

Schematic



A = 25°C)

	–55°C to +125°C
	–30°C to +100°C
(1.6 mm below seating plane)	260°C for 10 s
Average Forward Current, IF	50 mA
Reverse Input Voltage, VR	6 V
Input Power Dissipation, PI	70 mW
Collector Current, IC	50 mA
Collector-Emitter Voltage, VCEO	35 V
Emitter-Collector Voltage, VECO	6 V
Collector Power Dissipation	150 mW
Total Power Dissipation	200 mW
Isolation Voltage, Viso (AC for 1 minute, R.H. = 40 ~ 60%)	5000 Vrms

Electrical Specifications (TA = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Forward Voltage	VF	–	1.2	1.4	V	IF = 20 mA
Reverse Current	IR	–	–	10	μA	VR = 4 V
Terminal Capacitance	Ct	–	30	250	pF	V = 0, f = 1 KHz
Collector Dark Current	I_{CEO}	–	–	100	nA	VCE = 20 V
Collector-Emitter Breakdown Voltage	BV_{CEO}	35	–	–	V	IC = 0.1 mA
Emitter-Collector Breakdown Voltage	BV_{ECO}	6	–	–	V	IE = 10 μA
Collector Current	IC	2.5	–	30	mA	IF = 5 mA, VCE = 5 V,
*Current Transfer Ratio	CTR	50	–	600	%	RBE = ∞
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	–	0.1	0.2	V	IF = 20 mA, IC = 1 mA
Response Time (Rise)	tr	–	4	18	μs	VCC = 2 V, IC = 2 mA
Response Time (Fall)	tf	–	3	18	μs	RL = 100 Ω
Cut-off Frequency	fc	–	80	–	KHz	VCC = 5 V, IC = 2 mA RL = 100 Ω, –3 dB
Isolation Resistance	R_{ISO}	5×10^{10}	1×10^{11}	–	Ω	DC 500 V 40 ~ 60% R.H.
Floating Capacitance	Cf	–	0.6	1.0	pF	V = 0, f = 1 MHz

Rank Mark	CTR (%)	Conditions
L	50 ~ 100	IF = 5 mA, VCE = 5 V, TA = 25°C
A	80 ~ 160	
B	130 ~ 260	
C	200 ~ 400	
D	300 ~ 600	

Relay-

HRS4(H) Relay

1-1.Nominal Voltage	3 to 48VDC
1-2.Coil Resistance	Refer to Table 1
1-3.Operate Voltage	Refer to Table 1
1-4.Release Voltage	Refer to Table 1
1-5.Nominal Power Consumption	360 to 450 mW

2.CONTACT DATA

2-1.Contact Arrangement	1 Form A,1 Form C
2-2.Contact Material	AgAlloy
2-3.Contact Rating	10A 120VAC/24VDC, 10A/6A 250VAC(1C) 15A 120VAC/24VDC,10A 250VAC(1A) TV-5
2-4.Max.Switching Voltage	110VDC/240VAC
2-5.Max.Switching Current	15A
2-6.Max.Switching Power	1800VA,360W
2-7.Contact Resistance(Initial)	≤50mΩ. at 6VDC 1A
2-8.Life Expectancy	
Electrical	100,000 operations at nominal load
Mechanical	10,000,000 operations

3.GENERAL DATA

3-1.Insulation Resistance	Min.1000MΩ. at 500VDC
3-2.Dielectric Strength	750VAC,1min between open contacts 1,500VAC,1min between contacts and coil
3-3.Operate Time	Max.10ms
3-4.Release Time	Max.5ms
3-5.Temperature Range	-30 to +85 °C
3-6.Shock Resistance	
Endurance	1,000m/s^2
Misoperation	100m/s
3-7.Vibration Resistance	
Endurance	10 to 55Hz,1.5mm Double Amplitude
Misoperation	10 to 55Hz,1.5mm Double Amplitude
3-8.Heating	80±2°C 96hs
3-9.Cold	-40± 2 C 96hs
3-10.Humidity	35% to 85%RH
3-11.Weight	12gr.
3-12.Safety Standard	UL NO.E164730 TUV NO.50036455 CSA NO.LR109368 CQC NO.02001001299