VISVESVRAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI – 590014

A project report on

"AGRIBOT FOR INTUITIVE FARMING"

Submitted in partial fulfillment of the requirements for the award of the degree of
BACHELOR OF ENGINEERING
in

ELECTRONICS AND COMMUNICATION ENGINEERING

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Academic Year 2018-2019

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CERTIFICATE

*This is to certify that the project work entitled "**AGRIBOT FOR INTUITIVE FARMING**", is a bonafide work carried out by **AJITH MUTHU (1MV15EC006)**, **H V SUJETH (1MV15EC038)**, **HEMANTHV (1MV15EC044)** and **MAHESWAR REDDY C (1MV15EC061)** in the partial fulfillment for the award of degree of **Bachelor of Engineering** in **Electronics and communication Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2018-19. It is certified that all the corrections/suggestions indicated for the internal assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the Bachelor of Engineering degree.*

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ACKNOWLEDGEMENTS

Any achievement, be it scholastic 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 would like to thank **Dr V.R. Manjunath,** Principal, Sir M.VIT, for the excellent study environment he has maintained and his moral support towards completing such endeavors.

We acknowledge with thanks the kind of patronage, loving inspiration, and timely guidance provided by our head of the department and guide, **Dr. R. Sundaraguru** which has immensely contributed to the success of our project. We really appreciate the help of all the faculty members of the Electronics and Communication Department in improving the quality of our project and report.

We would like to thank our families for their undivided support and encouragement to complete this project. We also thank our friends who have provided us with invaluable suggestions and feedback.

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DECLARATION

We hereby declare that the entire project work embodied in this discretion has been carried out by us and no part has been submitted for any Degree of any institution separately.

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ABSTRACT

As India is mainly agriculture country. Agriculture is the most important occupation for most of the Indian families. More than 40 percent of the population in the world chooses agriculture as the primary occupation.. In India, agriculture contributes about sixteen percent (16%) of total GDP and 10% of total exports. Agriculture played vital role of countries development, it helped in improving economy of the country but from past couple of decades, state of agriculture hadn't improved much. It was even declining in sum of the areas. Formers had started to utilize different agricultural techniques, fertilizers, hybrid seeds etc. Agricultural is the backbone of Indian economy through, with the growth of other sectors, the overall share of agriculture. On GDP of the country as decreased. Still agriculture continuous to play a dominant part in the overall economic scenario of India. The problems faced by formers in agriculture are during seed sowing, in land cultivation, in spaying of pesticides etc. In recent years, increased interest has grown for the development of the autonomous vehicles like robots in the agriculture. It is designed to minimize the labor of farmers in addition to increasing the speed and accuracy of the work. So, to reducing the man power and giving the security for formers life and solution for their problems we introducing the robot in agriculture specially in seed sowing, pesticides sprayer , land leveling, water and pesticide spraying and land cultivating as well as its use for the society.

The existing agricultural robot performs basic elementary functions like harvesting and planting. The proposed system aims at designing multipurpose agricultural robotic vehicle (device) which can be controlled through Bluetooth for their operation. The environment for humidity levels are continuously monitored by placing moisture sensors. This is especially important for the workers in the area of potentially harmful for the safety and health of the workers. These robots are used to reduce human intervention, ensuring proper irrigation and efficient utilization of resources.

Developed agriculture needs to find new ways to improve efficiency by utilizing technologies on smart machines that can do right thing, in the right place, at the right time in the right way.

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Chapter 1

INTRODUCTION

We can also implement with the advancement in sensors and control systems that allow for optimal resource and integrated disease and pest management different kinds of robotic technologies being used in armed forces, Navy, Army, Air land are also being used in industrial and smart applications. Some of the robots are also being used in the wars of Afghanistan and Iraq, also, the robots that are under investigation in laboratories for future military operations. These robots are under investigation for autonomous and cooperative environment. We focus our attention on the uses of robots in Agriculture especially in growing, pesticide apply, seeds sowing, crop harvesting as well as its use for the society..

Agribot is a robot designed for agricultural purposes. It is designed to minimize the labor of farmers in addition to increasing the speed and accuracy of the work. It performs the elementary functions involved in farming i.e. cultivating the field, sowing of seeds, land leveling and pesticide spraying. The robot provides the facility for optional switching of the cultivating system when required. Many countries in Asia including India are agrarian economies and most of their rural populations depend on agriculture to earn their livelihood. Aimed at increasing the productivity and reducing the labor involved, this robot is designed to execute the most of the main functions required to be carried out in farms to increase the yield and to decrease the man power and save time. With the help of robots, agricultural operations such as spraying, watching the farm day and night, allowing farmers to reduce the environmental impact, increase precision in an effective manner.

The Advantage of this techniques is:

- Robots can work nonstop and in hazardous environment.
- Due to the light weight of the robots they do not compact the soil as large machinery does.
- Increase the efficiency of farming.
- Lower production cost.
- High quality of fresh products.

We can also implement with the advancement in sensors and control systems that allow for optimal resource and integrated disease and pest management.

To perform the function of ploughing it is equipped with spiked wheels which are fixed in the anterior end of the robot, to sow seeds it has a container with seeds and its bottom contains a perforation to drop the seed, it contains an cultivator attached at the end for cultivating the land in terms of loosening the land before seeding and finally the posterior end of the robot has a sprayer equipped with solenoid valve which is controlled by a relay. Precision farming is the operation, guidance, and control of machines to carry out agricultural tasks. It motivates agricultural robotics. The goal of agricultural robotics is more than just the application of robotics technologies to agriculture.

Chapter 2

OBJECTIVES

- To bring advancements in the field of agriculture.
- Use smart machines to increase the efficiency in the growth of agricultural products.
- Reduce the use of man power.
- To provide manual control with the help of Bluetooth.
- To bring awareness to the farmers about the technology and keep them benefited.
- The challenge of natural variation.
- To overcome the drawbacks faced by humans.

PROBLEM STATEMENT

The existing method of seed sowing, cultivation, and pesticide spraying etc. process is associated with extensive human effort. In the traditional method of seed sowing process it is difficult to achieve uniform soil depth for seed placement and to obtain uniform distance between the seed placement. In addition to this the overall utilization of the field is less due to the low germination rate of the seeds as its difficult to achieve uniform cover of soil over the seed. The seeds will not germinate if the depth of the seeds placed is more. Crop harvesting is a major problem because it need so much of man power and it involves heavy cost. Manual pesticide spraying leads for so many diseases to farmers like allergies, asthma and respiration problems. Manual way of irrigation system is not scientific and leads for waste of water. In order to overcome these limitation in the existing process, a robot is developed that can perform the seeding operation, soil cultivation, pesticide spraying and irrigation autonomously in an advance way so as improve the yield and productivity with saving time and energy.

Chapter 3

LITERATURE SURVEY

1. Precision Agriculture Using Agribot for the Welfare of Farmers

P. Prakash, B. Priyadharshini , G.Thiriveni and Mr.V.Gowrishankar ,UG Students, Department of ECE, Velalar College of Engineering and Technology, India. Assistant Professor, Department of ECE, Velalar College of Engineering and Technology, India.2018, *Asian journal Of applied Science and Technology, Volume-2 Pg 730-736, June-2018*

More than 40 percent of the population in the world chooses agriculture as the primary occupation. In recent years, increased interest has grown for the development of the autonomous vehicles like robots in the agriculture. Agribot is a robot designed for agricultural purposes. It is designed to minimize the labor of farmers in addition to increasing the speed and accuracy of the work. It performs the elementary functions involved in farming i.e. spraying of pesticide, sowing of seeds, and so on. The existing agricultural robot performs basic elementary functions like harvesting, planting and spreading the pesticides. The Proposed system aims at designing multipurpose autonomous agricultural robotic vehicle which can be controlled through Bluetooth for seeding and spraying of pesticides. This is especially important for the workers in the area of potentially harmful for the safety and health of the workers. These robots are used to reduce human intervention, ensuring proper irrigation and efficient utilization of resources.

Many countries in Asia including India are agrarian economies and most of their rural populations depend on agriculture to earn their livelihood. Aimed at increasing the productivity and reducing the labor involved, this robot is designed to execute the basic functions required to be carried out in farms. All kinds of agricultural robots have been researched and developed to implement a number of agricultural products in many countries. This Agribot can performs basic elementary functions like ploughing, planting and spray the pesticides. The application of agricultural machinery in precision agriculture has experienced an increase in investment. The robot starts its function by ploughing of soil followed by sowing of seeds and ends the process by spraying of pesticides. It uses basic components like DC motors, servo motor, relay, solenoid valve and Arduino as the main controller. The mechanical design of the robot is also simple. It is programmed to carry out the above functions simultaneously. To perform the function of ploughing it is equipped with spiked wheels which are fixed in the anterior end of the robot, to sow seeds it has a container with seeds and its bottom contains a perforation to drop the seed and finally the posterior end of the robot has a sprayer equipped with solenoid valve which is controlled by a relay. Precision autonomous farming is the operation, guidance, and control of autonomous machines to carry out agricultural tasks. It motivates

agricultural robotics. The goal of agricultural robotics is more than just the application of robotics technologies to agriculture.

2. Design of Cell Phone Operated Robot Using DTMF for Object Research

Manish Kumar, *IEEE Wireless and Optical Communications Networks (WOCN), 2013 Tenth International Conference on 26-28 July 2013*.

In recent years, there are development of robotics and communication on a large scale. Here we are using both the technologies together. Our robot is controlled by cell phone by DTMF technology through this we can make robot move in desire direction by touchpad. This robot can be make more useful by adding applications to it here we are using some sensor which can detect object and we are adding a robotic arm to the robot which can pick & place object but the decision to pick object or not will taken by operator by giving reply of message sent by GSM module and it will also give information about the object to operator about the metallic property of the object which is tested by metal detector coil fixed in arm. This is how we can use this robot for research purpose in different field by further manipulation in programming it can use accordingly.

For the space research or for the places where human cannot reach this robot is design its movements will be control by user and robot pick the desire object and test it. In recent many research has been going on communication and developed for the betterment of society. In this project we are using communication technology that is DTMF (dual tone multi frequency) to control the robot movement that is generated by cell phone. To decode the DTMF tone DTMF decoder is used along with the microcontroller (Atmel 89S52) and its output is connected to motor driving IC and its output is given to motor which are connected to wheels. The second most important thing is robot arm, it helps to pick an object and detects the metallic and non-metallic type of object and its controlling is done by GSM module through messages.

This paper includes the project with the combination of robotics and communication i.e. DTMF and with the help of it robot can move according to instruction and pick the object and test the object. This project can be used for research and with further development it can be use research in the places where human cannot survive and it's beyond their reach through adding camera.There is various future application of this robot by using different sensors and other technologies. In this project we are using arm as an application. By using smart phone and video calling we can also see the location of the object and use it for research and also we can locate its position in Google Earth by GPS.

3. DTMF Based Intelligent Farming Robotic Vehicle

G. Rajesh, "Microcontroller Based Drip Irrigation System", *International Journal of Emerging Science and Engineering (IJESE) ISSN: 2319-6378, Volume-1, Issue-6, April 2013*.

The main objective of designing this robot is simply to facilitate the farmers in the future for agriculture purposes. In the present scenario, there are many recent developments in the field of robotics and agriculture on a large scale. In this paper we are using both the technologies. The methodology used in this paper is DTMF (Dual Tone Multi-Frequency). Our robot is controlled by a cell phone, through this we can make our machine communicate on a large scale over a large distance. This will help the farmer to control his agricultural works from a far distance without going in the field with an easy control.

This robot has a number of advantages as well as important features such as automatic avoiding obstacles in its way, automatics metal detection in its way. It can sense soil moisture according to which the machine will irrigate the field. It can also sow seeds in the field, remove the compost from the field as well as can control the pests with spraying facility as per the commands given by the farmer. As a result, This machine can also be used to reach the places where farmers make harder efforts for farming such as hill areas, mountains etc. where land is not plane. This is how we can use this robot in different fields as well as for research purpose by further manipulation in programming it can be modified accordingly.

Agriculture was the key development in the rise of human civilization. A remarkable change in agricultural practices has occurred over the past century in response to new technologies, and the development ofworld agricultural markets. This also has led to technological improvements in agricultural techniques. Robotics is the branch of technology that deals with the design, construction, operation, and application of robots, as well as computer systems for their control, sensory feedback, and information processing. The design of a given rover will often incorporate agricultural efforts, though it may not look much like a human being or function in a human like manner. These types of intelligent systems having robust and feasible model with a number of integrated functionalities is the demand of future in every field of technology, for the betterment of the society.

By developing this robotic vehicle with its multi-tasking agricultural features, we have overcome the difficulty of farmers in farming their land in every season no matter what is the weather that day also this has a large range as this machine can be controlled from anywhere in the world just using this

DTMF technology. The main advantage of this robot is that it is that it facilitates the farmers to ease their work and increase the productivity with its multitasking working features.

Considering all the situations, the robot integrated with different sub modules can be used for redemption and agricultural purposes worldwide especially countries like India where agriculture provides the principal means of livelihood for the major Indian population.

4. Certain investigation of precision agriculture robot using lab view

S.Mohan , Department of Digital Electronics and Communication, Nehru Institute of Technology, Coimbatore, India. *International Conference on Current Trends in Engineering and Technology, ICCTET-2103*

Developed agriculture needs to find new ways to improve efficiency. One approach is to utilize available information technologies in the form of more intelligent machines to reduce and target energy inputs in more effective ways than in the past. Precision Farming has shown benefits of this approach but we can now move towards a new generation of equipment. The advent of autonomous system architectures gives us the opportunity to develop a complete new range of agricultural equipment based on small smart machines that can do the right thing, in the right place, at the right time in the right way.

Autonomous agricultural robots that could identify, spray and pick individual rice and wheat may soon be a reality. The process might help advance other fields too including robotic surgery and other medical application. The concept of designing agriculture robot can be achieved by using lab view software and GSM to interface the robot and PC.

Commercial farms of the future may be staffed by robots that will identify, spray and pick individual pieces of produce from plants, even when their targets are producing rice and wheat by robot in agricultural field. As scientists in Israel and Europe get closer to this goal, experts say the work has a number of potential benefits. Autonomous agricultural robots could protect human workers from the harmful effects of handling chemicals by hand. And through a system of highly selective spraying, robots could reduce a farm's use of pesticides by up to 80 percent.

This paper has set out a vision of how aspects of crop production could be automated in the future. Although existing manned operations can be efficient over large areas there is a potential for reducing the scale of treatments with autonomous machines that may Result in even higher efficiencies.

The development process may be incremental but the Overall concept requires a paradigm shift in the way we think about mechanization for crop production that is based more on plant needs and novel ways of meeting them rather than modifying existing techniques.

5. Agricultural Robot for Automatic Ploughing and Seeding

Amrita Sneha.A, 2Abirami.E, 3 Ankita.A,4 Mrs.R.Praveena, 5 Mrs.R.Srimeena 1, 2, 3, 4, 5 Department of Electronics and Instrumentation Engineering Easwari Engineering College, Chennai, Tamil Nadu, India,
IEEE International Conference on Technological Innovations in ICT for Agricultural and Rural Development TIAR-2015.

This paper strives to develop a robot capable of performing operations like automatic ploughing, seed dispensing, fruit picking and pesticide spraying. It also provides manual control when required and keeps tabs on the humidity with the help of humidity sensors .The main component here is the AVR At mega microcontroller that supervises the entire process. Initially the robot tills the entire field and proceeds to ploughing, simultaneously dispensing seeds side by side. The device used for navigation is an ultrasonic sensor which continuously sends data to the microcontroller. On the field the robot operates on automated mode, but outside the field is strictly operated in manual mode. For manual control the robot uses the Bluetooth pairing app as control device and helps in the navigation of the robot outside the field. The field is fitted with humidity sensors placed at various spots that continuously monitor the environment for humidity levels. It checks these levels with the set point for humidity and alerts the farmer. The alerting mechanism is GSM module that sends a text message to the farmer informing him about the breach in set point. The farmer then responds via SMS to either switch on the water sprinklers or ignore the alert. The water sprinklers, if on, bring down the humidity level thus providing an ideal growing environment to crop. The concept of fruit picking and pesticide spraying is described under the process domain. Farmers today spend a lot of money on machines that help them decrease labor and increase yield of crops but the profit and efficiency are very less. Hence automation is the ideal solution to overcome all the shortcomings by creating machines that perform one operations and automating it to increase yield on a large scale. Keywords: Agrobots, Advanced Virtual Risc (AVR), Bluetooth, Humidity sensors, Machine vision system.

An initial outcome of this study indicates that most of these systems that which work autonomously are more flexible than traditional systems. The benefits of reduction in labor costs and restrictions on the number of daily working hours significantly improved. Thus it has made possible to automate the most significant working routines. However some have failed due to the requirement of accuracy of specific tasks. In addition, at this stage of development, the initial investment and annual costs of expensive GPS system are still relatively high but it seems possible to design economic viable robotic systems for grass cutting, crop scouting and autonomous weeding. Findings show that there is a significant potential for applying these systems if it's possible to impose adequate control and safety regulations systems at reasonable costs. Moreover, a comparison between different European countries indicates that labor costs, cost rotation and farm structure may have a tremendous impact on the potential use of these systems.

Chapter 4

Work flow Methodology

The project mainly consists of two modules. One is the transmitter part another one is the receiver part. The transmitter par a Bluetooth enabled smart phone for controlling robot and is used for establishing communication between transmitter and receiver. The receiver is a robotic device which can be used to move the device in agricultural land for sowing seeds, cultivating, pesticide spraying and so on. The operator can operate the transmitter part, by using the keys given he can move the device present at receiver side any direction like front, back, left, right and stop. In this project, it is presenting that the farm seed sowing process in advanced agriculture system which is controlled by microcontroller assembly. The technique of seed sowing based on row per column with fixed standard distance depending upon type of crop or type of cultivation. The system includes bluetooth, six DC motor, one sprayer, three containers each for seeds storage, pesticides spray and water sprinkling, moisture sensor and whole parts are controlled by microcontroller assembly as designed in hardware. The operation of DC motor is based on simple electromagnetism, used to give energy to the wheels of vehicle

Depending upon the revolution per minute of DC motor axel, it drives vehicle at particular distance, the crop cutting tool motor i.e. robotic arm will be worked and controlled. When Robot start moving in the agricultural land seeds will start dispensing from the containers and will be sowed in the land. Once after sowing the seeds the soil will be leveled by leveler. The water will sprayed after leveling the land. Later water will be supplied based on the requirement. If the land is found dry then only water will be sprinkled automatically by using moisture sensors. The power needed for the operation of robot will be obtained by a solar panel and energy will be stored in battery.

The Project uses Embedded Technology with wireless communication system to establish a secure network between the person who is operating the device and a device which is doing the task.

Basic Block Diagram

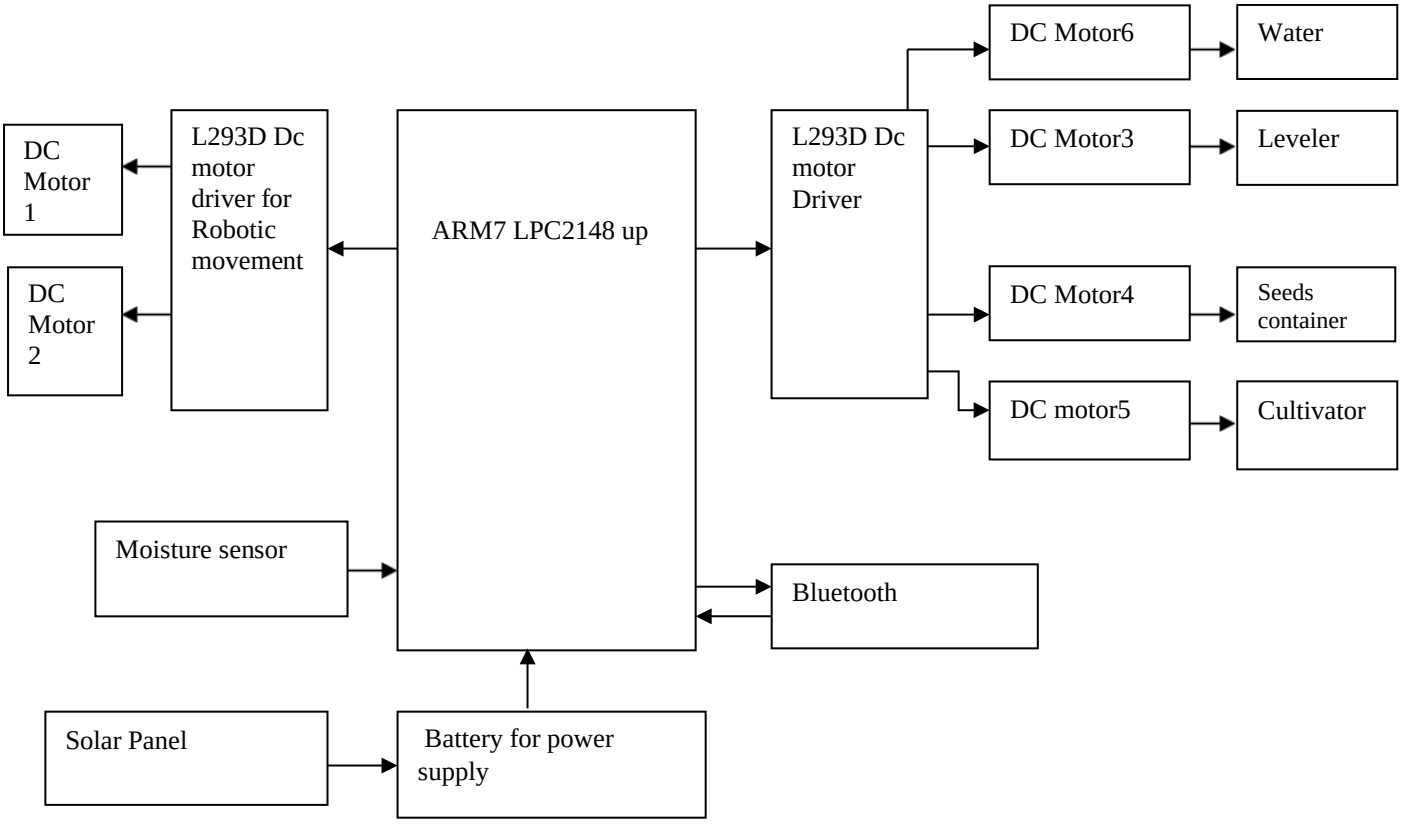


Fig : Basic block Diagram

Chapter 5

Hardware and Software Required

Hardware

- Arm7 Lpc2148 uc
- L293D Driver
- Dc Motors
- Containers
- Bluetooth
- Moisture sensor
- Solar Panel
- Battery

Software Required

- Embedded.C
- Keiluv5
- H-JTag

HARDWARE

BATTERY

How does the Lead Acid Battery Work?

Invented by the French physician Gaston Planté in 1859, lead acid was the first rechargeable battery for commercial use. Despite its advanced age, the lead chemistry continues to be in wide use today. There are good reasons for its popularity; lead acid is dependable and inexpensive on a cost-per-watt base. There are few other batteries that deliver bulk power as cheaply as lead acid, and this makes the battery cost-effective for automobiles, golf cars, forklifts, marine and uninterruptible power supplies (UPS).

The grid structure of the lead acid battery is made from a lead alloy. Pure lead is too soft and would not support itself, so small quantities of other metals are added to get the mechanical strength and improve electrical properties. The most common additives are antimony, calcium, tin and selenium. These batteries are often known

as lead-antimony" and "leadcalcium."

Adding antimony and tin improves deep cycling but this increases water consumption and escalates the need to equalize. Calcium reduces self-discharge, but the positive lead-calcium plate has the side effect of growing due to grid oxidation when being over-charged. Modern lead acid batteries also make use of doping agents such as selenium, cadmium, tin and arseni to lower the antimony and calcium content .

Lead acid is heavy and is less durable than nickel- and lithium-based systems when deep cycled. A full discharge causes strain and each discharge/charge cycle permanently robs the battery of a small amount of capacity. This loss is small while the battery is in good operating condition, but the fading increases once the performance drops to half the nominal capacity. This wear-down characteristic applies to all batteries in various degrees.

Depending on the depth of discharge, lead acid for deep-cycle applications provides 200 to 300 discharge/charge cycles. The primary reasons for its relatively short cycle life are grid corrosion on the positive electrode, depletion of the active material and expansion of the positive plates. This aging phenomenon is accelerated at elevated operating temperatures and when drawing high discharge currents.

Charging a lead acid battery is simple, but the correct voltage limits must be observed. Choosing a low voltage limit shelters the battery, but this produces poor performance and causes a buildup of sulfation on the negative plate. A high voltage limit improves performance but forms grid corrosion on the positive plate. While sulfation can be reversed if serviced in time, corrosion is permanent.

Lead acid does not lend itself to fast charging and with most types, a full charge takes 14–16 hours. The battery must always be stored at full state-of-charge. Low charge causes sulfation, a condition that robs the battery of performance. Adding carbon on the negative electrode reduces this problem but this lowers the specific energy

Lead acid has a moderate life span, but it is not subject to memory as nickel-based systems are, and the charge retention is best among rechargeable batteries. While NiCd loses approximately 40 percent of their stored energy in three months, lead acid self-discharges the same amount in one year. The lead acid battery works well at cold temperatures and is superior to lithium-ion when operating in subzero conditions.

Sealed Lead Acid

The first sealed, or maintenance-free, lead acid emerged in the mid-1970s. Engineers argued that the term "sealed lead acid" was a misnomer because no lead acid battery can be totally sealed. To control venting during stressful charge and rapid discharge, valves have been added that release gases if pressure builds up. Rather than submerging the plates in a liquid, the electrolyte is impregnated into a moistened separator, a design that resembles nickel- and lithium-based systems. This enables operating the battery in any physical orientation without leakage.

The sealed battery contains less electrolyte than the flooded type, hence the term "acid-starved." Perhaps the most significant advantage of sealed lead acid is the ability to combine oxygen and hydrogen to create water and prevent dry out during cycling. The recombination occurs at a moderate pressure of 0.14 bar (2psi). The valve serves as a safety vent if the gas buildup rises. Repeated venting should be avoided as this will lead to an eventual dry-out.

Several types of sealed lead acid have emerged and the most common are *gel*, also known as *valve-regulated lead acid* (VRLA), and *absorbent glass mat* (AGM). The gel cell contains a silica type gel that suspends the electrolyte in a paste. Smaller packs with capacities of up to 30Ah are often called SLA (sealed lead acid). Packaged in a plastic container, these batteries are used for small UPS, emergency lighting and wheelchairs. Because of low price, dependable service and low maintenance, the SLA remains the preferred choice for healthcare in hospitals and retirement homes. The larger VRLA is used as power backup for cellular repeater towers, Internet, hubs, banks, hospitals, airports and more.

The AGM suspends the electrolyte in a specially designed glass mat. This offers several advantages to lead acid systems, including faster charging and instant high load currents on demand. AGM works best as a mid-range battery with capacities of 30 to 100Ah and is less suited for large systems, such as UPS. Typical uses are starter batteries for motorcycles, start-stop function for micro-hybrid cars, as well as marine and RV that need some cycling.

With cycling and age, the capacity of AGM fades gradually; gel, on the other hand, has a dome shaped performance curve and stays in the high performance range longer but then drops suddenly towards the end of life. AGM is more expensive than flooded, but is cheaper than gel. (Gel would be too expensive for start/stop use in car).

Unlike the flooded, the sealed lead acid battery is designed with a low over-voltage potential to prohibit the battery from reaching its gas-generating potential during charge. Excess charging causes gassing, venting and subsequent water depletion and dry-out. Consequently, gel, and in part also AGM, cannot be charged to their full potential and the charge voltage limit must be set lower than that of a flooded. This also applies to the float charge on full charge. In respect to charging, the gel and AGM are no direct replacements for the flooded type. If no designated charger is available for AGM with lower voltage settings, disconnect the charger after 24 hours of charge. This prevents gassing due to a float voltage that is set too high.

The optimum operating temperature for a VRLA battery is 25°C (77°F); every 8°C (15°F) rise above this temperature threshold cuts battery life in half. (See BU-806a: How Heat and Loading affect Battery Life) Lead acid batteries are rated at a 5-hour (0.2C) and 20-hour (0.05C) discharge rate. The battery performs best when discharged slowly; the capacity readings are substantially higher at a slower discharge than at the 1C-rate. Lead acid can, however, deliver high pulse currents of several C if done for only a few seconds. This makes the lead acid well suited as a starter battery, also known as starter-light-ignition (SLI). The high lead content and the sulfuric acid make lead acid environment friendly.

Lead acid batteries are commonly classified into three usages: Automotive (starter or SLI), motive power (traction or deep cycle) and stationary (UPS).

BLUETOOTH

Description

It is a class-2 Bluetooth module with Serial Port Profile, which can configure as either Master or slave. a Drop-in replacement for wired serial connections, transparent usage. You can use it simply for a serial port replacement to establish connection between HC-05 Specification

HC-05 Specification

- Bluetooth protocol: Bluetooth Specification v2.0+EDR
- Frequency: 2.4GHz ISM band
- Modulation: GFSK(Gaussian Frequency Shift Keying)
- Emission power: 4dBm, Class 2
- Sensitivity: -84dBm at 0.1% BER
- Speed: Asynchronous: 2.1Mbps(Max) / 160 kbps, Synchronous: 1Mbps/1Mbps
- Security: Authentication and encryption
- Profiles: Bluetooth serial port
- Power supply: +3.3VDC 50mA
- Working temperature: -20 ~ +75Centigrade
- Dimension: 26.9mm x 13mm x 2.2 mm

Application

- Computer and peripheral devices
- Industrial control
- MCU projects

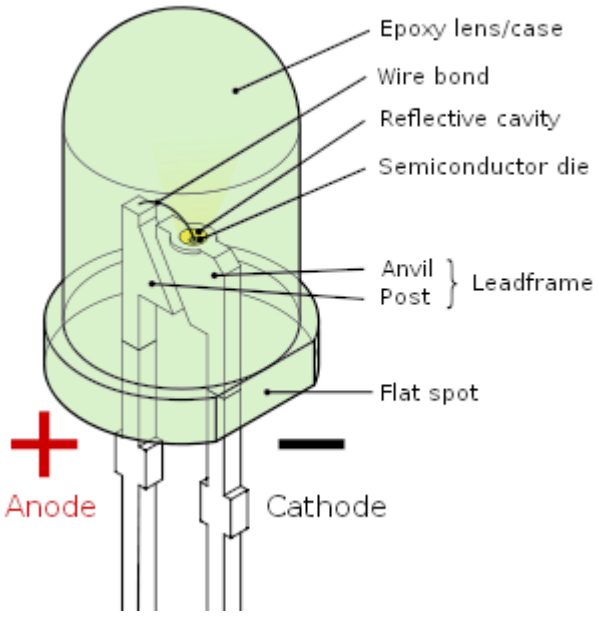
How to interface With Microcontroller

Note 1: This is a single unit only. We recommend the purchase a USB dongle to interface to a computer if you do not already have access to a computer with Bluetooth connectivity.

Note 2: Do not attach this device directly to a PC RS232 Port. You will need an RS232 to TTL converter circuit if you need to attach this to a computer

Note 3: I/O Pins are not 5V Tolerant , use level converter for interfacing with 5V Microcontrollers

Light-emitting diode

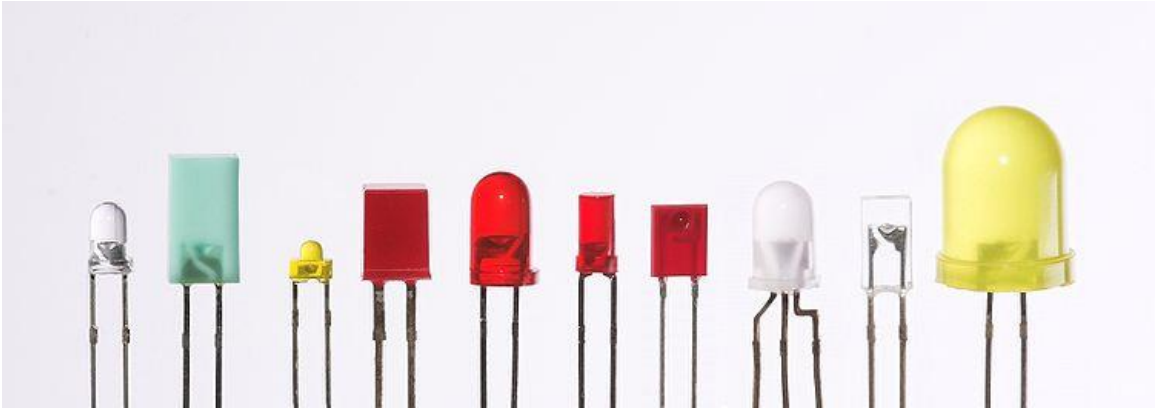


A light-emitting diode (LED) is an electronic light source. LEDs are used as indicator lamps in many kinds of electronics and increasingly for lighting. LEDs work by the effect of electroluminescence, discovered by accident in 1907. The LED was introduced as a practical electronic component in 1962. All early devices emitted low-intensity red light, but modern LEDs are available across the visible, ultraviolet and infra red wavelengths, with very high brightness.

LEDs are based on the semiconductor diode. When the diode is forward biased (switched on), electrons are able to recombine with holes and energy is released in the form of light. This effect is called electroluminescence and the color of the light is determined by the energy gap of the semiconductor. The LED is usually small in area (less than 1 mm^2) with integrated optical components to shape its radiation pattern and assist in reflection.

LEDs present many advantages over traditional light sources including lower energy consumption, longer lifetime, improved robustness, smaller size and faster switching. However, they are relatively expensive and require more precise current and heat management than traditional light sources.

Applications of LEDs are diverse. They are used as low-energy indicators but also for replacements for traditional light sources in general lighting, automotive lighting and traffic signals. The compact size of LEDs has allowed new text and video displays and sensors to be developed, while their high switching rates are useful in communications technology.



Various types LED

RED, YELLOW AND GREEN LEDs

Figure 3.8: red, yellow and green leds

A **light-emitting diode** (**LED**) is a semiconductor light source. LEDs are used as indicator lamps in many devices and are increasingly used for other lighting. Appearing as practical electronic components in 1962, early LEDs emitted low-intensity red light, but modern versions are available across the visible, ultraviolet, and infrared wavelengths, with very high brightness. When a light-emitting diode is switched on, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence and the color of the light (corresponding to the energy of the photon) is determined by the energy gap of the semiconductor. An LED is often small in area (less than 1 mm^2), and integrated optical components may be used to shape its radiation pattern. LEDs present many advantages over incandescent light

sources including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching. However, LEDs powerful enough for room lighting are relatively expensive and require more precise current and heat management than compact fluorescent lamp sources of comparable output.

Light-emitting diodes are used in applications as diverse as aviation lighting, automotive lighting, advertising, general lighting, and traffic signals. LEDs have allowed new text, video displays, and sensors to be developed, while their high switching rates are also useful in advanced communications technology. Infrared LEDs are also used in the remote control units of many commercial products including televisions, DVD players and other domestic appliances. LEDs are also used in seven-segment display.

LMx35, LMx35A Precision Temperature Sensors

Description

The LM135 series are precision, easily-calibrated, • Directly Calibrated to the Kelvin Temperature Scale integrated circuit temperature sensors. Operating as a 2-terminal zener, the LM135 has a breakdown

• 1°C Initial Accuracy Available voltage directly proportional to absolute temperature

• Operates from 400 μA to 5 mA at 10 mV/°K. With less than 1-Ω dynamic impedance,

• Less than 1-Ω Dynamic Impedance the device operates over a current range of 400 μA to

• Easily Calibrated 5 mA with virtually no change in performance. When calibrated at 25°C, the LM135 has typically less than

• Wide Operating Temperature Range 1°C error over a 100°C temperature range. Unlike

• 200°C Overrange other sensors, the LM135 has a linear output.

• Low Cost Applications for the LM135 include almost any type of

temperature sensing over a −55°C to 150°C

Applications temperature range. The low impedance and linear

• Power Supplies output make interfacing to readout or control circuitry are especially easy.

• Battery Management

• HVAC The LM135 operates over a −55°C to 150°C temperature range while the LM235 operates over a

• Appliances −40°C to 125°C temperature range. The LM335 operates from −40°C to 100°C. The LMx35 devices are available packaged in hermetic TO transistor packages while the LM335 is also available in plastic TO-92 packages.

5 2 x 16 PARALLEL LCD

The 2 X16 Parallel LCD is an 8 bit or 4 bit parallel interfaced LCD. This unit allows the user to display text, numerical data and custom created characters. The LCD uses the HD44780 series LCD driver from Hitachi, or equivalent controller. The LCD is connected to a female 14-pin connector for easy interface with the BS2p24/40 Demo Board (#45187) and the Professional Development Board (#28138).Many manufacturers of displays integrated the controller with their product making it the informal standard for this type of displays.[1] The device can display ASCII characters, JapaneseKana characters, and some symbols in two 28 character lines. Using an extension driver, the device can display up to 80 characters

Though the device has the ribbon cable and 14-pin connector it may also be hooked up manually.

3.5.1 TECHNICAL SPECIFICATIONS

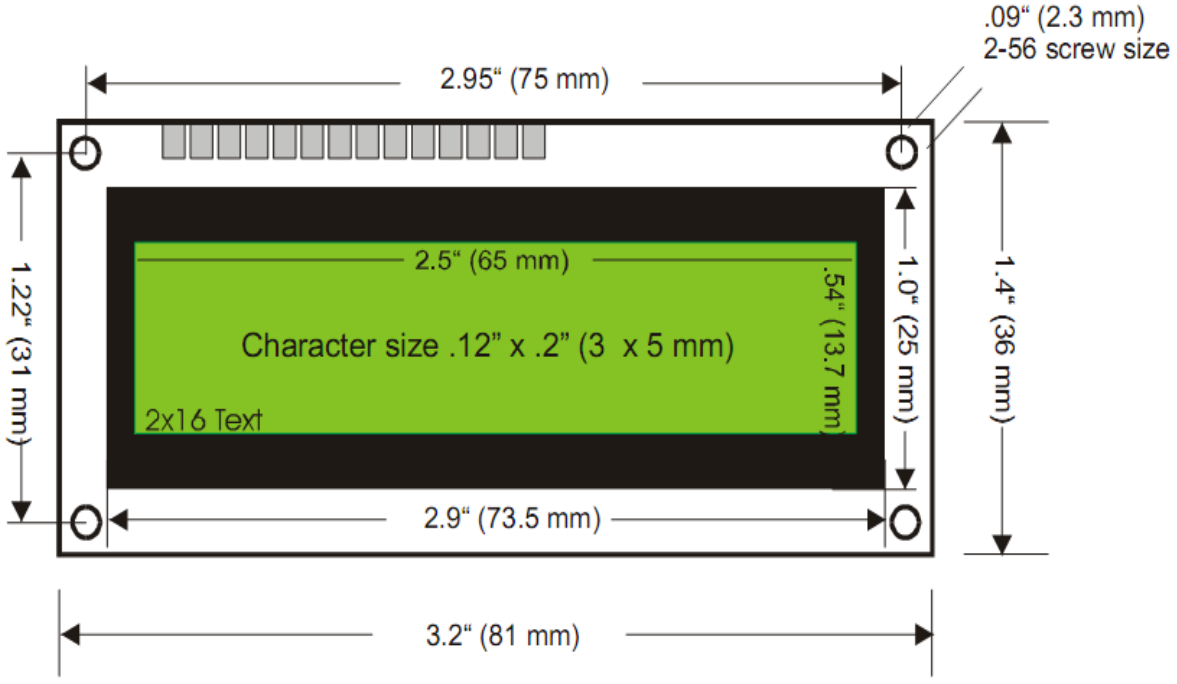


Fig 3.10 : Specifications of 16 x 2 LCD.

FEATURES

- 5× 8 and 5 × 10 dot matrix possible .
- Low power operation support 2.7 to 5.5V .
- Wide range of liquid crystal display driver power .
- Liquid crystal drive waveform .
- A (One line frequency AC waveform).
- Correspond to high speed MPU bus interface.

- 4-bit or 8-bit MPU interface enabled.
- 80 × 8-bit display RAM (80 characters max.) .
- Automatic reset circuit that initializes the controller/driver after power on.
- Internal oscillator with external resistors.
- Low power consumption.

GENERAL EXPLANATION

We have to prepare an LCD properly before the character we need, has to be displayed. For this a number of commands have to be provided to the LCD before inputting the required data.

RS- Register Select

There are 2 very important registers in LCD

- Command Code register
- Data Register

If RS=0 $\longrightarrow$ Instruction command Code register is selected, allowing user to send command

RS=1 $\longrightarrow$ Data register is selected allowing to send data that has to be displayed.

R\W- Read\Write

R\W input allows the user to write information to LCD or read information from it. How do we read data from LCD????? The data that is being currently displayed will be stored in a buffer memory DDRAM. This data could be read if necessary.

If R\W=1 $\longrightarrow$ Reading

R\W=0 $\longrightarrow$ Writing

E- Enable

The enable Pin is used by the LCD to latch information at its data pins. When data is supplied to data pins, a high to low pulse must be applied to this pin in order for the LCD to latch the data present in the data pins.

EToggle: $\longrightarrow$

Data Bus- D0-D7 .

VDD-Power 5V .

Vss- GND .

VEE- LCD Contrast Adjustment .

LPC 2148 MICRO CONTROLLER

Intro to the ARM architecture

ARM is founded on the Reduced Instruction Set (RISC) principle. In simple words, this means that each instruction is designed to complete in one clock cycle, keeping the instructions simple. In other words, this takes away the complexity from the CPU and instead puts it onto the compiler.

The other aspect of ARM is that is is based on a Load Store Architecture. To *load* a value from memory, you copy the data from memory into a register. Similary, to store a value to memory, you copy the data from a register to memory. All operations take place on data held in registers.

Registers

Perhaps one of the most important concepts to understand in ARM is the use of registers. As noted earlier, all processing occurs on data held in the registers and not directly in memory, so its worthwhile spending some time on this.

In the ARM state, there are 16 general purpose registers visible at any one time (labelled r0-r15). Each register is 32 bits in size, and usually each register has a specific purpose as dictated by the ARM procedure call standard (AAPCS), although the compliance to these by your compiler may vary:

• r0-r3: Holds arguments passed to function (Additional arguments passed by stack)

• r4-r11: Hold local variables in a function

• r12: Intra-Procedure-call scratch register. Can also be used by the linker to implement veneers, or be safely used as a scratch registers by the called function

• r13: Stack Pointer (SP). Can also be used as a general purpose register (ARM state only)

• r14: Link Register (LR) : Function return address. Can also be used as a general purpose register.

• r15: Program Counter (PC) : Address of next instruction to be fetched

In Thumb state, only 8 registers (r0-r7) are visible, although it is possible for some Thumb state instructions to access the higher (r8-r15) registers. Both states however give full access to PC, LR and CPSR (explained later) In C++, r0 or r1 is used as the this pointer. Also, a long long or a double takes 2 registers. Another point worth noting here is that if lots of data is to be passed, its better to bundle up the data in a structure and pass a pointer

to it rather than passing all that data directly, since that ways a register can be used instead of the stack (using registers is much faster than using the stack)
The VFP register bank is shared with the NEON register bank (more on these later), however these remain distinct from the ARM register bank.
The CPSR is a special type of register known as the **C**urrent **P**rogram **S**tatus **R**egister. The various bits of the CPSR indicate different things:

•Condition flags [O**v**erflow, Sticky Overflow (**Q**), **C**arry, **Z**ero, **N**egative]

•Processor Mode [User, Supervisor (SVQ), Interrupt (IRQ), Fast Interrupt (FIQ), Undefined, Abort, System]

•Processor State (ARM/Thumb/Jazelle)

For instance, the ADDS instruction for instance will update N,C,Z,V flags in the CPSR based on the result.
A quick overview of some of the operating modes of the processor is as follows:

- User: This is the "normal" mode of execution for the processor
- Supervisor: Ssed mainly by SWIs and the OS. This mode has additional privileges which allow greater control of the computer
- IRQ: Used to handle peripherals that issues interrupts. This mode is also privileged. Such devices causing IRQs are the keyboard, the VSync (when the screen refresh is occurring), IOC timers, serial, harddisk, floppy etc etc…
- FIQ: Used to handle peripherals that issue fast interrupts. This mode is also privileged. Has more register switches than IRQ, and can interrupt and IRQ
- System: Special version of user mode with access to CPSR

Stack

The stack can be any combination of Ascending/Descending + Empty/Full

• Ascending: stack grows towards a higher address

• Descending: stack grows towards a lower address

• Empty: SP points to the next empty location

• Full: SP points to the last item pushed on the stack

The most common (and default) implementaion in ARM is fully descending, which means that the stack grows towards lower address and the stack pointer points to the last item pushed on the stack.
It is important to note that subroutines must preserve r4-r11 and SP, which are done by pushing these registers onto the stack. Furthermore, subroutines calling other subroutines must also preserve r14 which contains the return address in order to know where to resume function executing from after returning from the subroutine.

Instruction Sets

ARM

The ARM architecure primailry has 3 types of instruction sets, namely ARM, Thumb and the more recent Thumb-2. Lets look at each of them individually

- The ARM instructions are all 32 bits in size, and have a 3 operand instruction set format (operands can be registers, memory allocation or literal data).
- Most instructions are conditional (some exceptions include CLREX, PLD, RFE, BKPT, DMB, BLX).
- Access to 16 registers
- Barrel shifter is available as part of the instructions
- Processor “wakes up” in this state and all interrupts are handled in ARM state
- Provides high performance code at the expense of greater code size

Thumb

- Thumb instructions are 16 bit in size with the exception of BL/BLX (which are 32 bit)
- 2 operand instruction set format
- Only branch instructions are conditional
- Access to 8 visible registers with the exception of a few insructions which can access the other registers
- Stack accessible only through PUSH and POP instructions (which work on a fully descending stack)
- Barrel shifter not available as part of the instruction set; any shifts must be done through separate instructions
- Under the hood, the Thumb instruction is “expanded” into an ARM instruction
- Provide better code density at the expense of performance, although sometimes Thumb state can improve perfomance (e.g. the code might fit better in the cache)

Thumb-2

Thumb-2 is a much newer instruction set which was first introduced as part of ARMv6-T2 , and made the default from ARMv7 onwards.

- Combination of 16 bit and 32 bit instructions, with the aim to deliver ARM performance code with Thumb style code density
- Conditional executions are supported by the use of If-Then *(*IT*)* blocks, which means upto 4 instructions can be executed conditionally.
- Full access to VFP instructions
- It is possible to have a Thumb-2 only processor (e.g. Cortex-M3)

Microcontroller

The LPC-2148 microcontroller is based on a 16-bit/32-bit ARM7TDMI-S with real-time emulation and embedded trace support, that combine the microcontroller with embedded high-speed flash memory ranging from 32 KB to 512 KB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2148 is ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I^2C-bus and on-chip SRAM of 8 KB up to 40 KB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems.

Salient features of LPC 2148 microcontroller

The silent features of LPC 2148 microcontroller are as follows

- 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
- 8 KB to 40 KB of on-chip static RAM and 32 KB to 512 KB of on-chip flash memory.128-bit wide interface/accelerator enables high-speed 60 MHz operation.
- In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot loader software. Single flash sector or full chip erase in 400 ms and programming of 256 B in 1ms.
- Embedded-ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high-speed tracing of instruction execution.

- USB 2.0 Full-speed compliant device controller with 2 KB of endpoint RAM. In addition, the LPC2148 provides 8 KB of on-chip RAM accessible to USB by DMA.
- One or two (LPC2141/42 vs. LPC2144/46/48) 10-bit ADCs provide a total of 6/14 analog inputs, with conversion times as low as 2.44 microseconds per channel.
- Single 10-bit DAC provides variable analog output.
- Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.
- Low power Real-Time Clock (RTC) with independent power and 32 kHz clock input.
- Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus (400 kbit/s)
- SPI and SSP with buffering and variable data length capabilities.
- Vectored Interrupt Controller (VIC) with configurable priorities and vector addresses.
- Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.
- Up to 21 external interrupt pins available.
- 60 MHz maximum CPU clock available from programmable on-chip PLL with settling time of 100 □s.
- On-chip integrated oscillator operates with an external crystal from 1 MHz to 25 MHz.
- Power saving modes include Idle and Power-down.
- Individual enable/disable of peripheral functions as well as peripheral clock scaling for additional power optimization.
- Processor wake-up from Power-down mode via external interrupt or BOD.
- Single power supply chip with POR and BOD circuits:
- CPU operating voltage range of 3.0 V to 3.6 V (3.3 V □□10 %) with 5 V tolerant I/O pads.

The LPC2148 configures the ARM7TDMI-S processor in little-endian byte order. AHB peripherals are allocated a 2 megabyte range of addresses at the very top of the 4 gigabyte ARM memory space. Each AHB peripheral is allocated a 16 KB address space within the AHB address space. LPC2148 peripheral functions (other than the interrupt controller) are connected to the APB bus. The AHB to APB Bridge interfaces the APB bus to the AHB bus. APB peripherals are also allocated a 2 megabyte range of addresses, beginning at the 3.5 gigabyte address point. Each APB peripheral is allocated a 16 KB address space within the APB address space.

The connection of on-chip peripherals to device pins is controlled by a Pin Connect Block. This must be configured by software to fit specific application requirements for the use of peripheral functions and pins.

The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro-programmed

Complex Instruction Set Computers. This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core.

Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor (second) is being decoded, and a third instruction is being fetched from memory. The ARM7TDMI-S processor also employs a unique architectural strategy known as THUMB, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue.

BLOCK DIAGRAM OF LPC 2148 MICROCONTROLLER

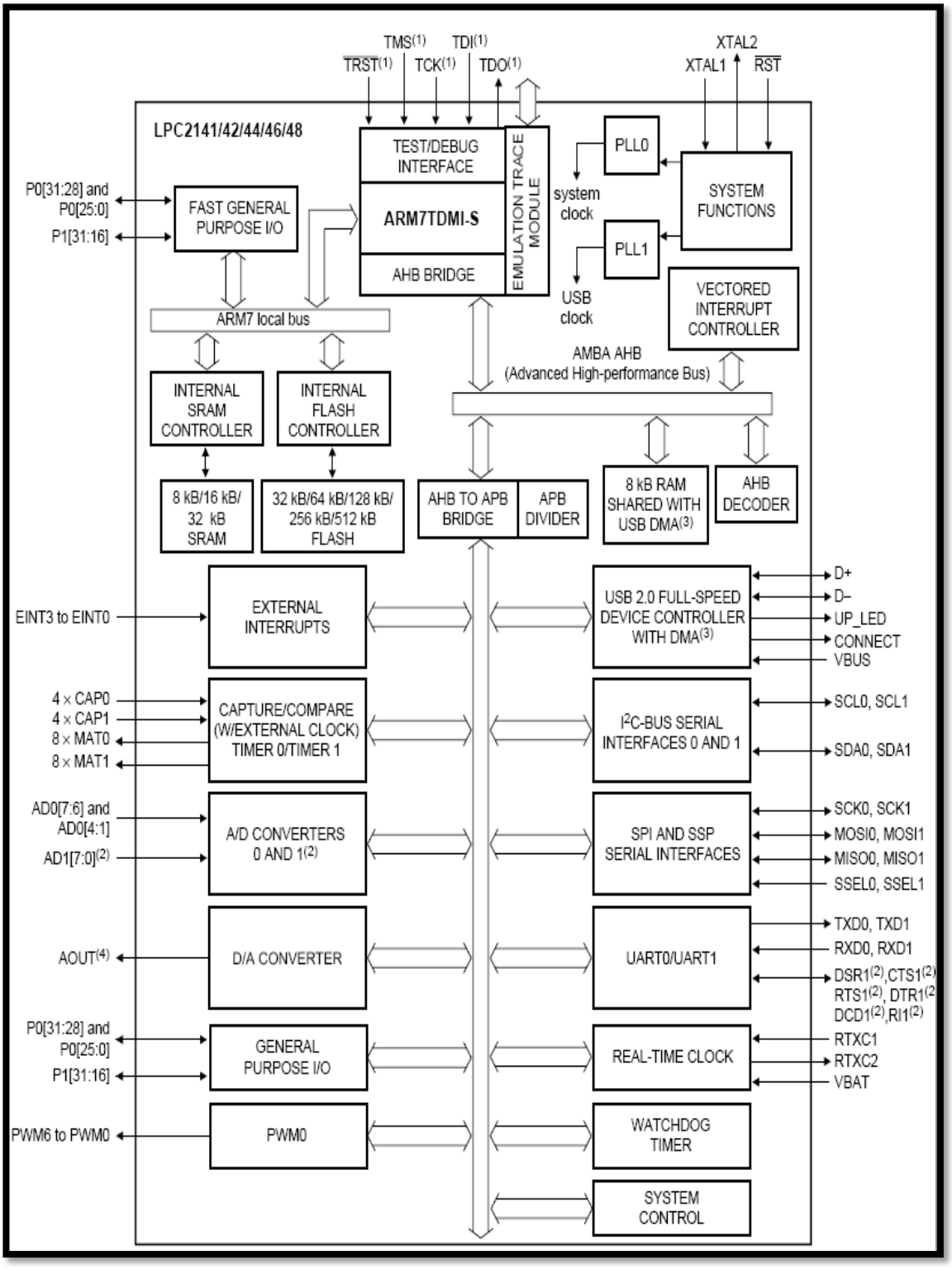


Figure 3.1.1: Block Diagram of LPC-2148

As shown in the below figure 3.3 the LPC2148 consists of an ARM7TDMI-S CPU with emulation support,

- The ARM7 Local Bus for interface to on-chip memory controllers,
- The AMBA Advanced High-performance Bus (AHB) for interface to the interrupt controller, and
- The ARM Peripheral Bus (APB, a compatible superset of ARM's AMBA Advanced Peripheral Bus) for connection to on-chip peripheral functions.

The key idea behind THUMB is that of a super-reduced instruction set. Essentially, the ARM7TDMI-S processor has two instruction sets:

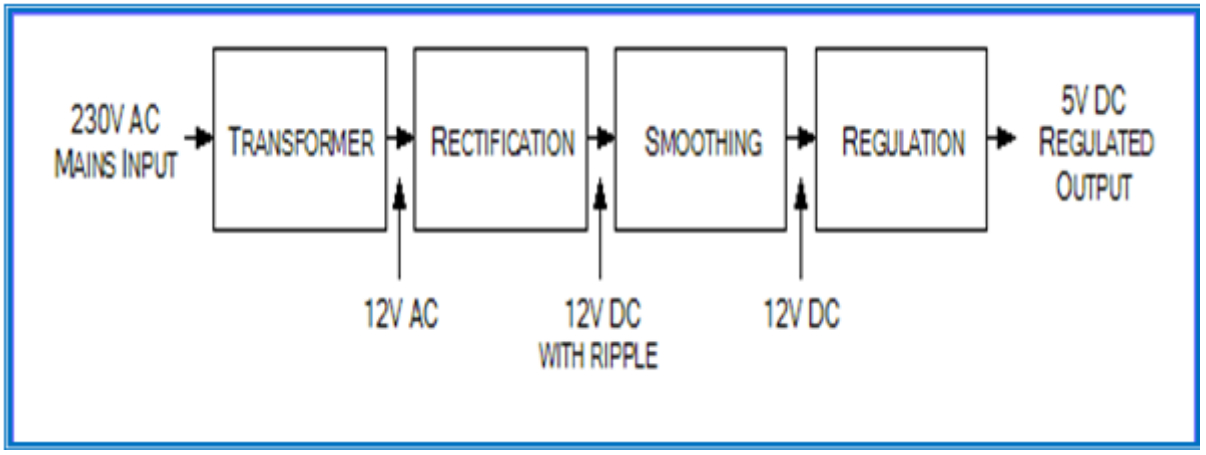
- The standard 32-bit ARM instruction set.
- A 16-bit THUMB instruction set.

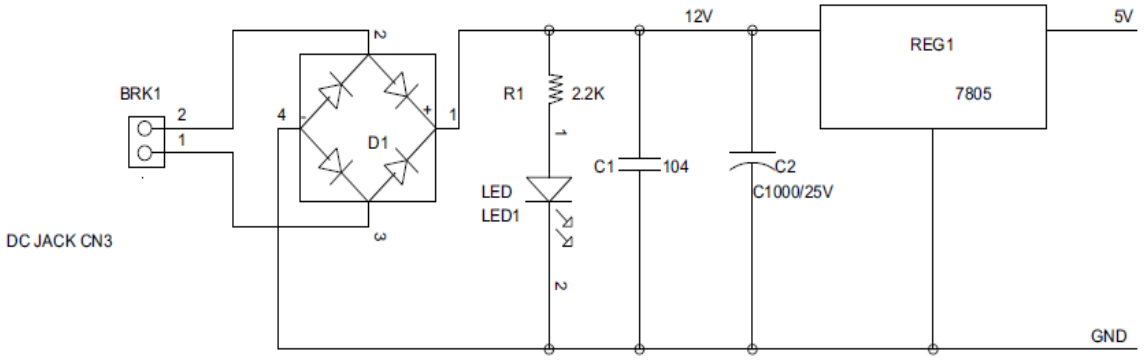
The THUMB set's 16-bit instruction length allows it to approach twice the density of standard ARM code while retaining most of the ARM's performance advantage over a traditional 16-bit processor using 16-bit registers. This is possible because THUMB code operates on the same 32-bit register set as ARM code.

THUMB code is able to provide up to 65% of the code size of ARM, and 160% of the performance of an equivalent ARM processor connected to a 16-bit memory system.

POWER SUPPLY UNIT

A power supply is a device or system that supplies electrical or other types of energy to an output load or group of loads. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.





Power supply unit consists of following units

1. Step down transformer
2. Rectifier unit
3. Input filter
4. Regulator unit
5. Output filter

RELAY

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be ON or OFF so relays have two switch position and they are double throw (changeover) switches.

Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) can not provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relay with 4 sets of changeover contacts are readily available. Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay.

The supplier's catalogue should show you the relay's connection. The coil will be obvious and it may be connected either way round. Relay coils produce brief high voltage 'spikes' when they are switched off and this can destroy transistors and ICs in the circuit. To prevent damage you must connect a protection diode across the relay coil.

The supplier's catalogue should show you the relay's connection. The coil will be obvious and it may be connected either way round. Relay coils produce brief high voltage 'spikes' when they are switched off and this can destroy transistors and ICs in the circuit. To prevent damage you must connect a protection diode across the relay coil.

The relay’s switch connections are usually contains COM, NC and NO.

COM = Common, always connect to this; it is the moving part of the switch.

NC = Normally Closed, COM is connected to this when the relay coil is off.

NO = Normally Open, COM is connected to this when the relay coil is on.

Connect to COM and NO if you want the switched circuit to be on when the relay coil is on. Connect to COM and NC if you want the switched circuit to be on when the relay coil is off. Most relays are SPDT or DPDT which are often described as "single pole changeover" (SPCO) Or "double pole changeover"(DPCO).

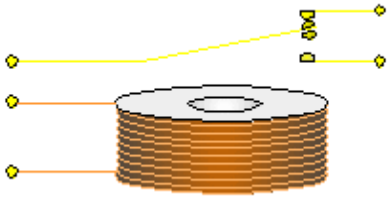


Fig 3.12 relay switching

This is a Single Pole Double Throw relay. Current will flow between the movable contact and one fixed contact when the coil is energized and between the movable contact and the alternate fixed contact when the relay coil is energized. The most commonly used relay in car audio, the Bosch relay, is a SPDT relay.

ADVANTAGES OF RELAY:

- Relays can switch AC and DC, transistors can only switch DC.
- Relays can switch high voltages, transistors cannot.
- Relays are a better choice for switching large currents (> 5A).
- Relays can switch many contacts at once.

EMBEDDED C

The C programming language is a popular and widely used programming language for creating computer programs. Programmers around the world Embrace C because it gives maximum control and efficiency to the programmer. And most of the time its not easy to build an application in assembly language which instead you can make easily in C. So its important that you know C language for ARM controller which is commonly known as Embedded C. As we use Kiel c51. Embedded C is designed for programmers with desktop experience in C,C++ or Java who want to learn the skills required for the unique challenges of embedded systems. If you are a programmer, or if you are interested in becoming a programmer, there are a couple of benefits you gain from learning C.

When designing software for a smaller embedded system with the LPC2148, it is very common place to develop the entire product using assembly code. With many projects, this is a feasible approach since the amount of code that must be generated is typically less than 8 kilobytes and is relatively simple in nature. If a hardware engineer is tasked with designing both the hardware and the software, he or she will frequently be tempted to write the software in assembly language. The trouble with projects done with assembly code can be difficult to read and maintain, especially if they are not well commented. Additionally, the amount of code reusable from a typical assembly language project is usually very low. Use of a higher-level language like C can directly address these issues.

A program written in C is easier to read than an assembly program. Since a C program possesses greater structure, it is easier to understand and maintain. Because of its modularity, a C program can better lend itself to reuse of code from project to project. The division of code into functions will force better structure of the software and lead to functions that can be taken from one project and used in another, thus reducing overall development time. A high order language such as C allows a developer to write code, which resembles a human's thought process more closely than does the equivalent assembly code. The developer can focus more time on designing the algorithms of the system rather than having to concentrate on their individual implementation. This will greatly reduce development time and debugging time since the code is more understandable. By using a language like C, the programmer does not have to be intimately familiar with the architecture of the target processor. This means that someone new to a given processor can get a project up and running quicker, since the internals and organization of the target processor do not have to be learned. Additionally, code developed in C will be more portable to other systems than code developed in assembly. Many target processors have C compilers available, which support ANSI C.

All of this is not to say that assembly language does not have its place. In fact, many embedded

systems(particularly real time systems) have a combination of C and assembly code. For time critical operations, assembly code is frequently the only way to go. One of the great things about the C language is that it allows you to perform low-level manipulations of the hardware if need be, yet provides you the functionality and abstraction of a higher order language.

Characteristics

- **Register Definitions, Initialization and Startup Code – C is a** high level programming language that is portable across many hardware architectures. This means that architecture specific features such as register definitions, initialization and startup code must be made available to your program via the use of libraries and include files. .
- **Basic C program structure –** all the programs you will write will have this basic structure. All variables must be declared at the start of a code block, you cannot declare variables among the program statements.
- **Programming memory models** The keil C compiler has two main C programming memory models, SMALL and LARGE which are related to this two types of memory. In the SMALL memory model the default storage location is the bytes of internal memory while in the LARGE memory model the default storage location is the externally addressed memory.
- **Special function registers –**. The value in the declaration specifies the memory location of the register: Extensions of the LPC2148 often have the low byte of a bit register preceding the high byte. In this scenario it is possible to declare a bit special function register, SFR , giving the addresses of the low byte: the memory location of the register used in the declaration must be a constant rather that a variable are expression.
- **Memory model used for a function –** The memory model used for a function can override the default memory model with the use of the small, compact are large keywords.

BRIEF DESCRIPTION OF OTHER COMPONENTS

RESISTOR

Resistor

Three resistors

Type	Passive
Electronic symbol	

(Europe)

(US)

A resistor is a two-terminal electronic component that produces a voltage across its terminals that is proportional to the electric current through it in accordance with Ohm's law:V = IR.

Resistors are elements of electrical networks and electronic circuits and are ubiquitous in most electronic equipment. Practical resistors can be made of various compounds and films, as well as resistance wire (wire made of a high-resistivity alloy, such as nickel/chrome).The primary characteristics of a resistor are the resistance, the tolerance, maximum working voltage and the power rating. Other characteristics include temperature coefficient, noise, and inductance. Less well-known is critical resistance, the value below which power dissipation limits the maximum permitted current flow, and above which the limit is applied voltage. Critical resistance depends upon the materials constituting the resistor as well as its physical dimensions; it's determined by design.Resistors can be integrated into hybrid and printed circuits, as well as integrated circuits. Size, and position of leads (or terminals) are relevant to equipment designers; resistors must be physically large enough not to overheat when dissipating their power.

CAPACITOR

Capacitor

Modern capacitors, by a cm rule.

Type	Passive
Invented	Ewald Georg von Kleist (October 1745)

Electronic symbol

A capacitor or condenser is a passive electronic component consisting of a pair of conductors separated by a dielectric. When a voltage potential difference exists between the conductors, an electric field is present in the dielectric. This field stores energy and produces a mechanical force between the plates. The effect is greatest between wide, flat, parallel, narrowly separated conductors.

An ideal capacitor is characterized by a single constant value, capacitance, which is measured in farads. This is the ratio of the electric charge on each conductor to the potential difference between them. In practice, the dielectric between the plates passes a small amount of leakage current. The conductors and leads introduce an equivalent series resistance and the dielectric has an electric field strength limit resulting in a breakdown voltage.

Capacitors are widely used in electronic circuits to block the flow of direct current while allowing alternating current to pass, to filter out interference, to smooth the output of power supplies, and for many other purposes. They are used in resonant circuits in radio frequency equipment to select particular frequencies from a signal with many frequencies.

Ceramic capacitor

In electronics ceramic capacitor is a capacitor constructed of alternating layers of metal and ceramic, with the ceramic material acting as the dielectric. The temperature coefficient depends on whether the dielectric is Class

1 or Class 2. A ceramic capacitor (especially the class 2) often has high dissipation factor, high frequency coefficient of dissipation.

ceramic capacitors

A ceramic capacitor is a two-terminal, non-polar device. The classical ceramic capacitor is the "disc capacitor". This device pre-dates the transistor and was used extensively in vacuum-tube equipment (e.g., radio receivers) from about 1930 through the 1950s, and in discrete transistor equipment from the 1950s through the 1980s. As of 2007, ceramic disc capacitors are in widespread use in electronic equipment, providing high capacity & small size at low price compared to other low value capacitor types.

Ceramic capacitors come in various shapes and styles, including:

- disc, resin coated, with through-hole leads
- multilayer rectangular block, surface mount
- bare leadless disc, sits in a slot in the PCB and is soldered in place, used for UHF applications
- tube shape, not popular now

Electrolytic capacitor

Axial lead (top) and radial lead (bottom) electrolytic capacitors

An electrolytic capacitor is a type of capacitor that uses an ionic conducting liquid as one of its plates with a larger capacitance per unit volume than other types. They are valuable in relatively high-current and low-frequency electrical circuits. This is especially the case in power-supply filters, where they store charge needed to moderate output voltage and current fluctuations in rectifier output. They are also widely used as coupling capacitors in circuits where AC should be conducted but DC should not.

Electrolytic capacitors can have a very high capacitance, allowing filters made with them to have very low corner frequencies.

Transistor

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Assorted discrete transistors.

A transistor is a semiconductor device commonly used to amplify or switch electronic signals. A transistor is made of a solid piece of a semiconductor material, with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current flowing through another pair of terminals. Because the controlled (output) power can be much more than the controlling (input) power, the transistor provides amplification of a signal. Some transistors are packaged individually but most are found in integrated circuits.

The transistor is the fundamental building block of modern electronic devices, and its presence is ubiquitous in modern electronic systems.

Usage

The bipolar junction transistor, or BJT, was the most commonly used transistor in the 1960s and 70s. Even after MOSFETs became widely available, the BJT remained the transistor of choice for many analog circuits such as simple amplifiers because of their greater linearity and ease of manufacture. Desirable properties of MOSFETs, such as their utility in low-power devices, usually in the CMOS configuration, allowed them to capture nearly all market share for digital circuits; more recently MOSFETs have captured most analog and power applications as well, including modern clocked analog circuits, voltage regulators, amplifiers, power transmitters, motor drivers, etc

Advantages

The key advantages that have allowed transistors to replace their vacuum tube predecessors in most applications are

- Small size and minimal weight, allowing the development of miniaturized electronic devices.
- Highly automated manufacturing processes, resulting in low per-unit cost.
- Lower possible operating voltages, making transistors suitable for small, battery-powered applications.
- No warm-up period for cathode heaters required after power application.
- Lower power dissipation and generally greater energy efficiency.
- Higher reliability and greater physical ruggedness.
- Extremely long life. Some transistorized devices have been in service for more than 30 years.
- Complementary devices available, facilitating the design of complementary-symmetry circuits, something not possible with vacuum tubes.
- Insensitivity to mechanical shock and vibration, thus avoiding the problem of microphonics in audio applications.

Limitations

- Silicon transistors do not operate at voltages higher than about 1,000 volts (SiC devices can be operated as high as 3,000 volts). In contrast, electron tubes have been developed that can be operated at tens of thousands of volts.
- High power, high frequency operation, such as used in over-the-air television broadcasting, is better achieved in electron tubes due to improved electron mobility in a vacuum.
- On average, a higher degree of amplification linearity can be achieved in electron tubes as compared to equivalent solid state devices, a characteristic that may be important in high fidelity audio reproduction.

- Silicon transistors are much more sensitive than electron tubes to an electromagnetic pulse, such as generated by an atmospheric nuclear explosion.

Bipolar junction transistor

The bipolar junction transistor (BJT) was the first type of transistor to be mass-produced. Bipolar transistors are so named because they conduct by using both majority and minority carriers. The three terminals of the BJT are named emitter, base, and collector. The BJT consists of two p-n junctions: the base–emitter junction and the base–collector junction, separated by a thin region of semiconductor known as the base region (two junction diodes wired together without sharing an intervening semiconducting region will not make a transistor). "The [BJT] is useful in amplifiers because the currents at the emitter and collector are controllable by the relatively small base current."[14] In an NPN transistor operating in the active region, the emitter-base junction is forward biased (electrons and holes recombine at the junction), and electrons are injected into the base region. Because the base is narrow, most of these electrons will diffuse into the reverse-biased (electrons and holes are formed at, and move away from the junction) base-collector junction and be swept into the collector; perhaps one-hundredth of the electrons will recombine in the base, which is the dominant mechanism in the base current. By controlling the number of electrons that can leave the base, the number of electrons entering the collector can be controlled.[14] Collector current is approximately β (common-emitter current gain) times the base current. It is typically greater than 100 for small-signal transistors but can be smaller in transistors designed for high-power applications.

Unlike the FET, the BJT is a low–input-impedance device. Also, as the base–emitter voltage (V_{be}) is increased the base–emitter current and hence the collector–emitter current (I_{ce}) increase exponentially according to the Shockley diode modeland the Ebers-Moll model. Because of this exponential relationship, the BJT has a higher transconductance than the FET.

Bipolar transistors can be made to conduct by exposure to light, since absorption of photons in the base region generates a photocurrent that acts as a base current; the collector current is approximately β times the photocurrent. Devices designed for this purpose have a transparent window in the package and are called phototransistors

Chapter 6

FEATURES

- Seed sowing
- Land cultivating
- Land levelling
- Water spraying
- Pesticide spraying
- Pruning

Chapter 7

APPLICATIONS

- The project can be used in military borders for detecting enemies since it uses wireless camera
- By adding few sensors the project can be used in Archeological department for finding ancient antique materials hidden.
- The project can used in vanishing Anti-terror activities like bomb disposal and so on.
- Since the data can be retrieved from remote places it can be used in Remote area Monitoring systems.
- The project can be used in Fire emergency conditions or fire fighting cases since it can spray the liquid
- It can be used in saving the children stuck in borewells since it have pick and place option.

Chapter 8

Conclusion

The project basically is a stepping stone towards bringing advancements in the field of agriculture by introducing high end technology devices like automatic pesticide sprayer and so on. We focus our attention on the uses of robots in Agriculture especially in growing, pesticide apply, seeds sowing, crop harvesting as well as its use for the society. Meanwhile reducing the use of manpower and giving security for formers life. THE Project uses Embedded Technology with wireless communication system to establish a secure network between the person who is operating the device and a device which is doing the task.

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