VISVESVARAYA TECHNOLOGICAL UNIVERSITY

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A Project Report
On

"BLUETOOTH CONTROLLED MULTI-AGRI VEHICLE"

Submitted in partial fulfillment of the requirements as a part of the curriculum,

Bachelors of Engineering in Mechanical Engineering

Submitted by

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CERTIFICATE

Certified that the project work entitled "**Bluetooth Controlled Multi-Agri Vehicle**" is a bonafide work carried out by **Mr. Chandan Reddy, Mr. Rohit Kumar Shaw, Mr. Sourish Bhattacharjee, Mr. Sushant Kumar Jha,** bonafide students of **CMR Institute of Technology** in partial fulfillment for of the requirements as a part of the curriculum, **Bachelors of Engineering in Mechanical Engineering,** of **Visvesvaraya Technological University, Belagavi** during the year **2019-20**. It is certified that all correction/suggestion indicated for 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 the project work prescribed for the bachelor of engineering degree.

(Mr. Dinesh R)	**(Dr. Vijayananda Kaup)**	**(Dr. Sanjay Jain)**
Signature of the Guide	**Signature of the HOD**	**Signature of the Principal**

External Viva

Name of the examiners	**Signature with date**

DECLARATION

We, students of Eighth Semester, B.E, Mechanical Engineering, CMR Institute of Technology, declare that the project work titled **"Bluetooth controlled multi-Agri vehicle"** has been carried out by us and submitted in partial fulfillment of the course requirements for the award of degree in **Bachelor of Engineering in Mechanical Engineering** of **Visvesvaraya Technological University, Belagavi,** during the academic year 2019-2020.

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ABSTRACT

India is an agriculture-based country in which 70% of the people depends on the outcome of farming. But if we observe that with increase in population, the farm gets distributed among the family and because of this, farmer in India held averagely only two-acre farm. Also, economically, farmers are very poor due to which they are unable to purchase tractors and other costly equipment, hence they use traditional method of farming. Basically, many farmers in India also use bullocks, horses and he-buffalo for farming operation. This will not satisfy need of energy requirement of the farming as compared to other countries in the world. So, we are thinking that human and animal efforts can be replaced by some advance mechanization which will be suitable for small scale farmer from economical and effort point of view. So, we are developing this equipment which will satisfy all this need and to solve. And for spraying used motor with 12V battery. Next two operations are manual base which is cultivation and sowing. This machine performs four farming operation (digging, sowing, spraying) which is used small scale farming. By using above attachments, one may perform various farming operations in less time and economically by adding latest technology using Bluetooth by Arduino controller.

ACKNOWLEDGEMENT

It is our proud privilege and duty to acknowledge the kind of help and guidance received from several people in preparation of this report. Apart from our own, the success of this project depends largely on the encouragement and guidelines of many others. It would have not been possible to prepare this report in this form without their valuable help, co- operation and guidance.

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CHAPTER 1

INTRODUCTION

Agriculture being one of the major occupations in India, it is very essential to discover and implement new idea in this field, though lot of work has been done in this area. It is observed that, these ideas are not been implemented properly in actual agricultural field. This is due to more cost and is daedal for rural people. Multipurpose agriculture equipment is basic and major equipment involved in agriculture for maximum yielding.

Conventional method of planting and cultivating the sugarcane is a laborious process and hence for that reason there is a scarcity of labours, this result in delayed agriculture to overcome these difficulties, multipurpose agriculture equipment is designed. Agriculture plays a vital role in the Indian economy. Over 70 % of the rural households depend on agriculture. Agriculture is an important sector of Indian economy as it contributes about 8.4% to the total GDP and provides employment to over 60% of the population. Indian agriculture has registered eloquent addition to over last few decades. Agriculture is the backbone of India. The agricultural history in India dates back to Indus Valley Civilization Era. Today, India ranks second worldwide in farm output. Some of the major problems in the Indian agricultural are rising of input costs, availability of skilled labours, lack of water resources and crop monitoring.

To overcome such adversity, the automation technologies were used in agriculture. The automation in the agriculture could help farmers to reduce their efforts. The special vehicles play a major role in various fields such as industrial, medical, military applications etc., The special vehicle field are gradually increasing its productivity in agriculture field. In the field of agricultural autonomous vehicle, a concept has been developed to investigate if multiple small autonomous machines could be more efficient than traditional large tractors and human forces.

The vehicles are being developed for the processes for ploughing, seed sowing, levelling, water spraying. All of these functions have not yet performed using a single vehicle. In this the robots are developed to concentrate in an efficient manner and also it is expected to perform the operations autonomously. The proposed idea implements the vehicle to perform the functions such as ploughing, seed sowing, mud levelling, water spraying. These functions can be integrated into a single vehicle and then performed.

1.1 PROBLEM STATEMENT:

 Lack of mechanization in farming

 Required excess efforts for different process.

 Required more man power.

 Excess time consumption for performing individual process.

1.2 OBJECTIVES:

The objective of this paper is to present the status of the current trends and implementation of Agricultural and autonomous systems and outline the potential for future applications. Different applications of autonomous vehicles in agriculture have been examined and compared with conventional systems and are proved as efficient and effective.

- To reduce human effort in the agricultural sector with the use of small robot.
- To perform all 4 operations at single time. It increases production and saves time.
- To complete large amount of work in less time. Farmer can operate this robot through remote by sitting at one side and he can operate easily.
- The usage of solar can be utilized for Battery charging. As the Robot works in the field, the rays of the sun can be used for solar power generation.
- To increase the efficiency, the solar power is used and the Power output can be increased.

Moreover, we will give examples of the economic potential of applying autonomous robotic vehicles compared to conventional systems. Focus will be put on potential labor cost savings, farm structure implications and sizes for operation, daily working hours, potential environmental impact, energy costs and safety issues

CHAPTER 2

LITERATURE SURVEY

1. **D.A. Mada, Sunday Mahai, [2013]**
   In this research paper author has mentioned importance of mechanization in agricultural by giving examples. The conclusion from the paper was need of multifunctional single axel vehicle for pre and post harvesting. We have taken this as base for our research and further production of our multifunctional agricultural vehicle.

2. **V.K. Tewari, A. Ashok Kumar, Satya Prakash Kumar, Brajesh Nare [2012]**
   In this research papers author have done case study on farm mechanization in west Bengal as being part of India it gives clear status about availability and progress in India. This ensured us to take right steps compared to current steps.

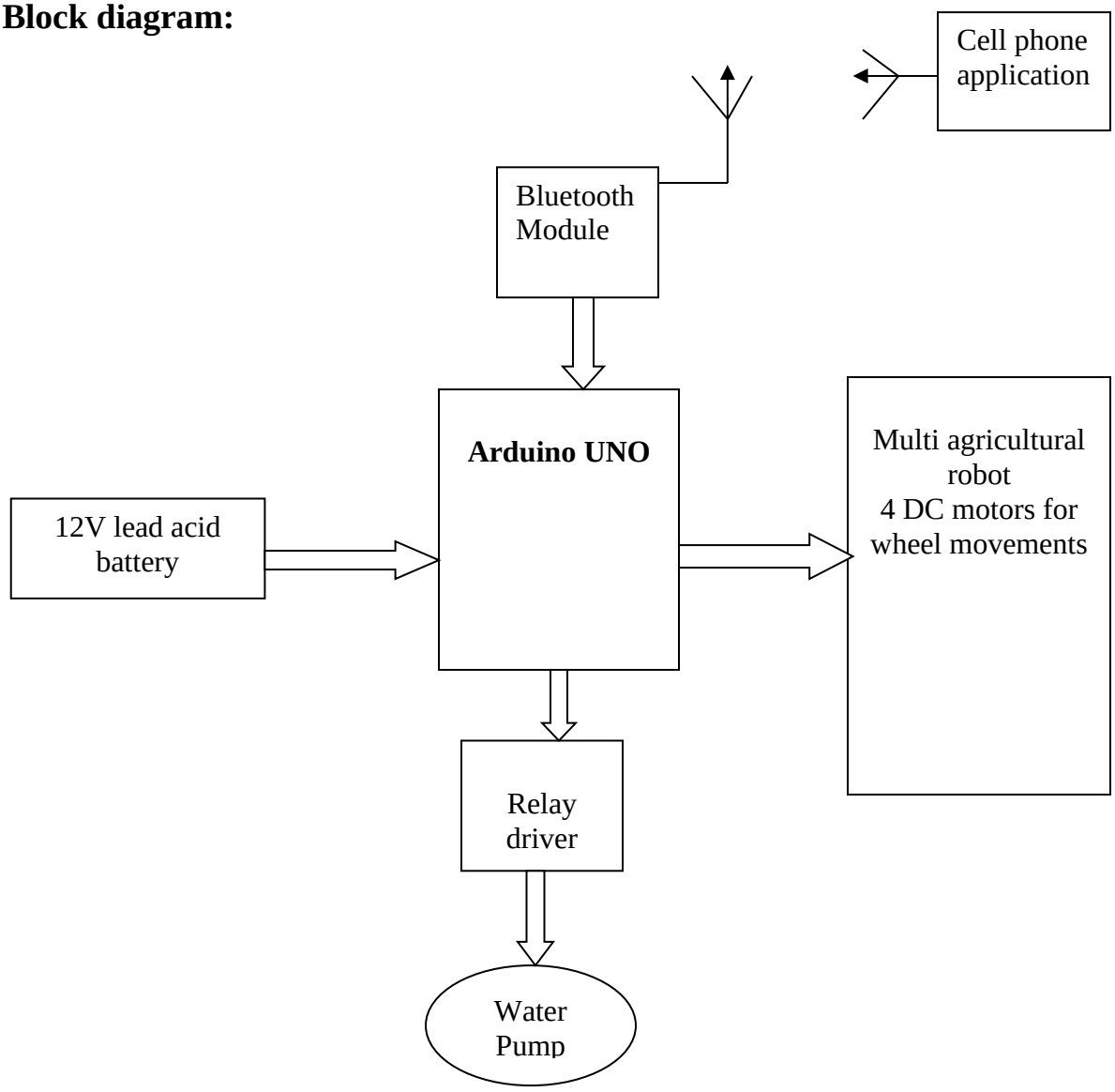
3. **F.A. Adamu, B. G. Jahun and B. Babangida [2014]**
   In this paper authors draws our attention towards the performance factor of a power tiller. Among those demand for light weight power tiller was sought out most. Fuel efficiency and field capacity such parameters are also discussed. We take those points in consideration while designing a sustainable multifunctional agricultural vehicle.

4. **P. Sarec, O. Sarec [2015]**
   The lowest values of soil penetration resistance below the cultivated profile were determined with the cultivators equipped with chisel shaped shares i.e. in the case of Farmet and Köckerling. Cultivators Väderstad TopDown 400 and Farmet Turbulent 450 showed good capacity in embedding plant residues. This result has taken for our research basis.

CHAPTER 3

METHODOLOGY

3.1 Block diagram:



3.2 WORKING PROCEDURE:

- Base frame is made for the robot with 4 wheels connected each with the dc geared motors at the rear wheel were each motor as max torque up to 5 to 6 kgs.
- One end of the frame, plowing tool is fitted and design is made to dig the soil which can penetrate max of 2.5 inches deep in to soil
- Funnel is kept on the rear wheel shaft were hole is made for the seed to flow through the hole according to the dug soil.
- Other end roller is fitted to close the seeds to the soil, and water tank is attached in the vehicle to sprayer at the end of the process through spray pump.
- Battery is mounted on chassis near to the handle shaft and motor is activated by battery current for spraying operation.
- An Android controlled automobile project that allows user to control a battery powered automobile wirelessly through an android application. The system uses a Bluetooth modem as a medium to transmit signals between the android based phone and to the Bluetooth.
- The microcontroller now processes the data sent by Bluetooth modem and checks for user commands. On recognizing direction commands sent by user (Forward/Backward), the microcontroller sends signals to appropriate driver IC's. The driver IC's now operate motors to achieve the desired movement of the automobile as sent by microcontroller.
- Using Bluetooth farmer can control motion of the vehicle forward, Left, right and stop. water pump ON/OFF and up/down mechanism of flowing machine is controlled by remotely using mobile app.

3.3 Sources required to develop this robotic machine:

- Sheet metal fabrication
- Drilling operations
- Lathe works
- Electrical works
- Welding works
- Fitting

3.4 Basic concept Design:

Concept to design a project for small scale farmers. And in one machine multi functions can be performed with cheap cost as compared to other agriculture machine. For this concept not essential to skilled person. Mechanism of the machine should be very simple. so, that for gardening and small-scale farming, design this concept.

3.5 Functions performed by the agri vehicle:

- Digging
- Sowing
- Soil covering
- Spraying

3.6 FACTORS DETERMINING THE CHOICE OF MATERIALS

The various factors which determine the choice of material are discussed below:

1. Properties

The material selected must possess the necessary properties for the proposed application. The various requirements to be satisfied can be weight, surface finish, rigidity, ability to withstand environmental attack from chemicals, service life, reliability etc. The following four types of principle properties of materials decisively affect their selection

- Physical properties: -

The various physical properties concerned are melting point, Thermal Conductivity, Specific heat, coefficient of thermal expansion, specific gravity, electrical Conductivity, Magnetic purposes etc.

- Mechanical properties: -

The various Mechanical properties Concerned are strength in tensile, compressive shear, bending, torsional and buckling load, fatigue resistance, impact resistance, elastic limit, endurance limit, and modulus of elasticity, hardness, wear resistance and sliding properties.

- The various other properties concerned from the manufacturing point of view are:

Cast ability, weld ability, brazing ability, forge ability, merchantability, surface properties, shrinkage, deep drawing, etc.

2. Manufacturing Case:

Sometimes the demand for lowest possible manufacturing cost or surface qualities obtainable by the application of suitable coating substances may demand the use of special materials.

3. Quality Required:

This generally affects the manufacturing process and ultimately the material. For example, it would never be desirable to go for casting of a smaller number of components which can be fabricated much more economically by welding or hand forging the steel.

4. Availability of Material:

Some materials may be scarce or in short supply. It then becomes obligatory for the designer to use some other material which though may not be a perfect substitute for the material designed. The delivery of materials and the delivery date of product should also be kept in mind.

5. Space Consideration:

Sometimes high strength materials have to be selected because the forces involved are high and the space limitations are there.

6. Cost:

As in any other problem, in selection of material the cost of material plays an important part and should not be ignored. Sometimes factors like scrap utilization, appearance, and non-maintenance of the designed part are involved in the selection of proper materials.

3.7 Functional Requirements:

It describes the basis functionality of the system, as expected once the system is deployed. Agricultural Robot should meet the following functional requirements:

1. Agricultural activities must be performed with minimal effect.
2. The application developed must be easily usable.
3. The farmer must be able to start, switch or stop any activity effortlessly and with minimum time.

3.8 Non-Functional Requirements:

This section describes additional performance criteria which the proposed system is aimed to meet. Some non-functional requirements are:

1. The total cost of the development must be nominal.

2. Performance must be high.

3. The size of the robot must be manageable.

3.9 COMPONENTS:

3.9.1 BLUETOOH HC-05 MODULE:

HC-05 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 MCU, PC to your embedded project, etc.

HC-05 Specifications:

- 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

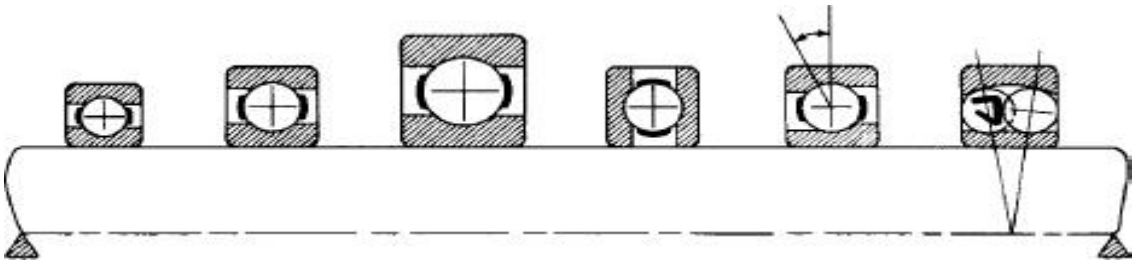
3.9.2 BEARING WITH BEARING CAP:

Description:

Ball and roller bearings are used widely in instruments and machines in order to minimize friction and power loss. While the concept of the ball bearing dates back at least to *Leonardo da Vinci*, their design and manufacture has become remarkably sophisticated. This technology was brought to its present state of perfection only after a long period of research and development. The benefits of such specialized research can be obtained when it is possible to use a standardized bearing of the proper size and type. However, such bearings cannot be used indiscriminately without a careful study of the loads and operating conditions. In addition, the bearing must be provided with adequate mounting, lubrication and sealing. The bearings are pressed smoothly to fit into the shafts because if hammered the bearing may develop cracks. Bearing is made up of steel material and bearing cap is made of mild steel.

Construction and Types of Ball Bearings:

A ball bearing usually consists of four parts: an inner ring, an outer ring, the balls and the cage or separator. To increase the contact area and permit larger loads to be carried, the balls run in curvilinear grooves in the rings. The radius of the groove is slightly larger than the radius of the ball, and a very slight amount of radial play must be provided. The bearing is thus permitted to adjust itself to small amounts of angular misalignment between the assembled shaft and mounting. The separator keeps the balls evenly spaced and prevents them from touching each other on the sides where their relative velocities are the greatest. Ball bearings are made in a wide variety of types and sizes. Single-row radial bearings are made in four series, extra light, light, medium, and heavy, for each bore, as illustrated in Fig. 1-3(a), (b), and (c).



100 Series 200 Series 300 Series Axial Thrust Angular Contact Self-Aligning Bearing

Fig. 3.1: Types of Ball Bearings

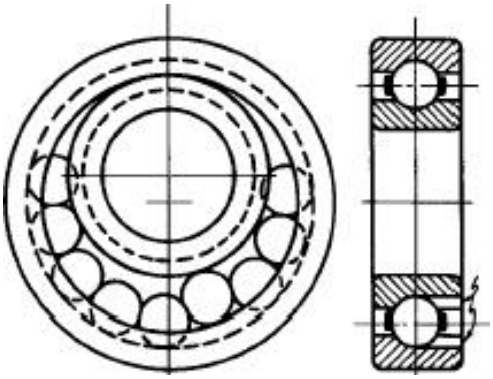


Fig. 3.2: Ball bearing sectional view

The heavy series of bearings is designated by 400. Most, but not all, manufacturers use a numbering system so devised that if the last two digits are multiplied by 5, the result will be the bore in millimetres.

The digit in the third place from the right indicates the series number. Thus, bearing 307 signifies a medium-series bearing of 35-mm bore. For additional digits, which may be present in the catalogue number of a bearing, refer to manufacturer's details.

Some makers list deep groove bearings and bearings with two rows of balls. For bearing designations of Quality Bearings & Components (QBC). The radial bearing is able to carry a considerable amount of axial thrust. However, when the load is directed entirely along the axis, the thrust type of bearing should be used. The angular contact bearing will take care of both radial and axial loads. The self-aligning ball bearing will take care of large amounts of angular misalignment. An increase in radial capacity may be secured by using rings with deep grooves, or by employing a double-row radial bearing. Radial bearings are divided into two general classes, depending on the method of assembly. These are the Conrad, or non-filling notch type, and the maximum, or filling-notch type. In the Conrad bearing, the balls are placed between the rings as shown in Fig. 1-4(a).

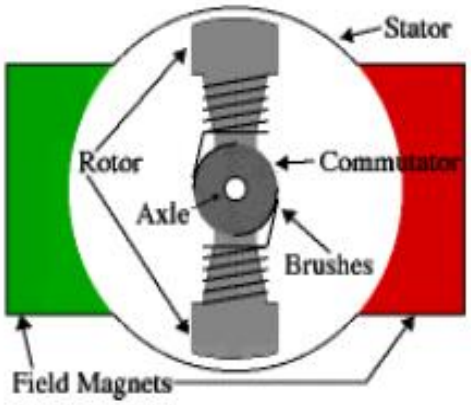
Then they are evenly spaced and the separator is riveted in place. In the maximum-type bearing, the balls are (a) (b) (c) (d) (e) (f) 100 Series Extra Light 200 Series Light 300 Series Medium Axial Thrust Bearing Angular Contact Bearing Self-Aligning Bearing

Fig. 1.3: Types of Ball Bearings

Fig. 1.4: Methods of Assembly for Ball Bearings

(a) Conrad or non-filling notch type

(b) Maximum or filling notch type



3.9.3 DC Motor:

A DC motor is a mechanically commutated electric motor powered from direct current (DC). The stator is stationary in space by definition and therefore so is its current. The current in the rotor is switched by the commutator to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque.

Fig 3.3: DC motor armature

DC motors have a rotating armature winding but non-rotating armature magnetic field and a static field winding or permanent magnet. Different connections of the field and armature winding provide different inherent speed/torque regulation characteristics. The speed of a DC motor can be controlled by changing the voltage applied to the armature or by changing the field current. The introduction of variable resistance in the armature circuit or field circuit allowed speed control. Modern DC motors are often controlled by power electronics systems called DC drives.

The introduction of DC motors to run machinery eliminated the need for local steam or internal combustion engines, and line shaft drive systems. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines.

Principle of Operation of DC Motor:

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

Let's start by looking at a simple 2-pole DC electric motor (here red represents a magnet or winding with a "North" polarization, while green represents a magnet or winding with a "South" polarization).

Every DC motor has six basic parts -- axle, rotor (a.k.a., armature), stator, commutator, field magnet(s), and brushes. In most common DC motors, the external magnetic field is produced

by high-strength permanent magnets1. The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces.

The rotors (together with the axle and attached commutator) rotate with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator. The above diagram shows a common motor layout -- with the rotor inside the stator (field) magnets. The DC Motors operate at 12 Volts and have the specification of 60 rotations per minute. In our project they are responsible for the movement of the Agribot and to perform harvesting and seed dropping.

Specifications of 180W wiper motor:

Power:180W, 24V & 12V

Stall torque: 100N.m

Low speed: 25+/-5rpm

high speed: 35+/-5rpm

Fig 3.4: Wiper motor

3.9.4 BATTERIES:

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. Batteries seem to be the only technically and economically available storage means.

LEAD-ACID WET CELL:

Where high values of load current are necessary, the lead-acid cell is the type most commonly used. The electrolyte is a dilute solution of sulfuric acid (H_2SO_4). In the application of battery power to start the engine in an auto mobile, for example, the load current to the starter motor is typically 200 to 400A. One cell has a nominal output of 2.1V, but lead-acid cells are often used in a series combination of three for a 6-V battery and six for a 12-V battery.

The lead acid cell type is a secondary cell or storage cell, which can be recharged. The charge and discharge cycle can be repeated many times to restore the output voltage, as long as the cell is in good physical condition. However, heat with excessive charge and discharge currents short ends the useful life to about 3 to 5 years for an automobile battery. Of the different types of secondary cells, the lead-acid type has the highest output voltage, which allows fewer cells for a specified battery voltage.

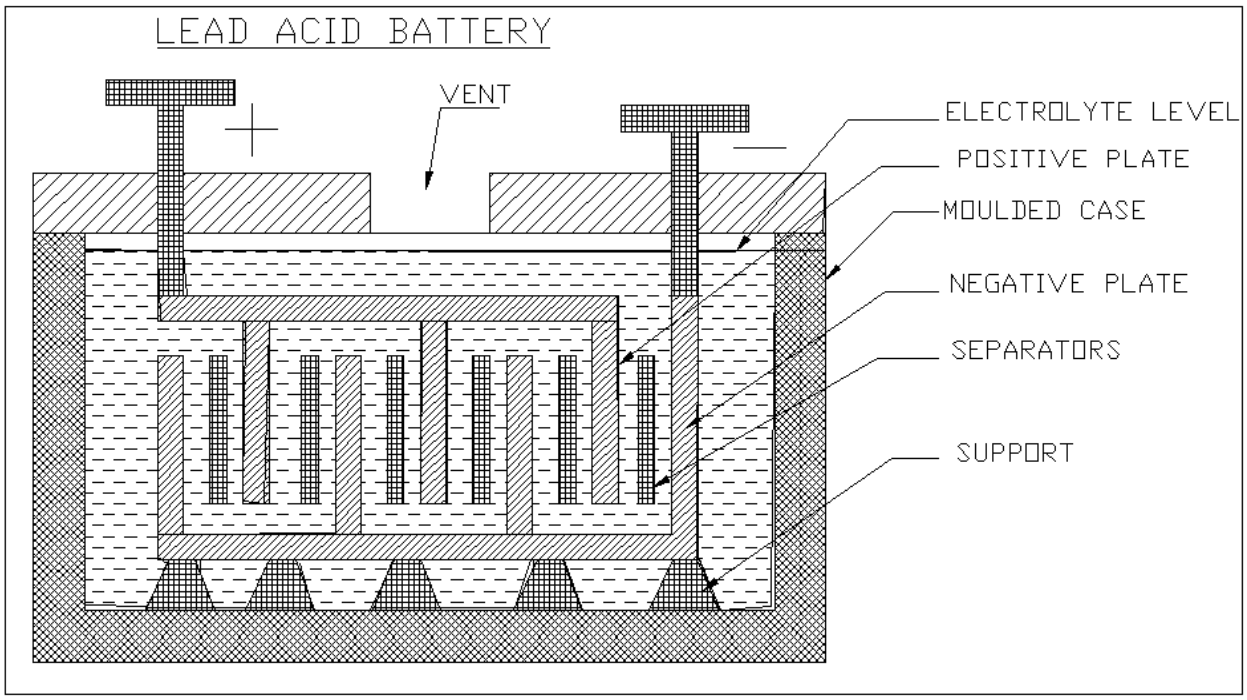


Fig 3.5: Lead acid battery

CONSTRUCTION:

Inside a lead-acid battery, the positive and negative electrodes consist of a group of plates welded to a connecting strap. The plates are immersed in the electrolyte, consisting of 8 parts of water to 3 parts of concentrated sulfuric acid. Each plate is a grid or framework, made of a lead-antimony alloy. This construction enables the active material, which is lead oxide, to be pasted into the grid. In manufacture of the cell, a forming charge produces the positive and negative electrodes. In the forming process, the active material in the positive plate is changed to lead peroxide (PbO_2). The negative electrode is spongy lead (Pb). Automobile batteries are usually shipped dry from the manufacturer. The electrolyte is put in at the time of installation, and then the battery is charged to from the plates. With maintenance-free batteries, little or no water need be added in normal service. Some types are sealed, except for a pressure vent, without provision for adding water.

WORKING:

Sulfuric acid is a combination of hydrogen and sulphate ions. When the cell discharges, lead peroxide from the positive electrode combines with hydrogen ions to form water and with sulphate ions to form lead sulphate. Combining lead on the negative plate with sulphate ions also produces he sulphate. Therefore, the net result of discharge is to produce more water, which dilutes the electrolyte, and to form lead sulphate on the plates.

As the discharge continues, the sulphate fills the pores of the grids, retarding circulation of acid in the active material. Lead sulphate is the powder often seen on the outside terminals of old batteries. When the combination of weak electrolyte and sulphating on the plate lowers the output of the battery, charging is necessary.

On charge, the external D.C. source reverses the current in the battery. The reversed direction of ions flows in the electrolyte result in a reversal of the chemical reactions. Now the lead sulphates on the positive plate reactive with the water and sulphate ions to produce lead peroxide and sulfuric acid. This action re-forms the positive plates and makes the electrolyte stronger by adding sulfuric acid.

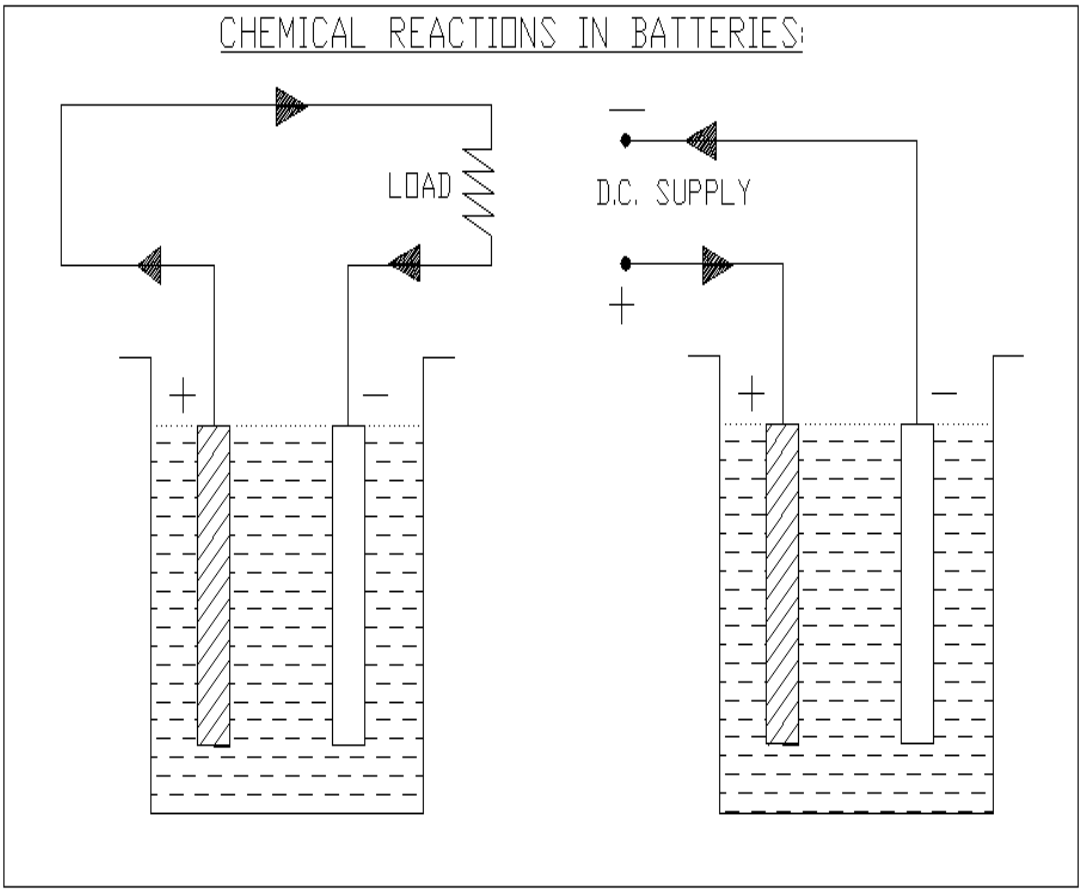


Fig 3.6: Chemical Reaction in batteries

3.10 Major Challenges Faced by Indian Agriculture:

1. Stagnation in Production of Major Crops:

Production of some of the major staple food crops like rice and wheat has been stagnating for quite some time. This is a situation which is worrying our agricultural scientists, planners and policy makers. If this trend continues, there would be a huge gap between the demand of ever-growing population and the production.

2. High cost of Farm Inputs:

Over the years rates of farm inputs have increased. Farm inputs include fertilizer, insecticide, pesticides, HYV seeds, farm labour cost etc. Such an increase puts low and medium land holding farmers at a disadvantage.

3. Soil Exhaustion:

Soil exhaustion means loss of nutrients in the soil from farming the same crop over and over again. This usually happens in the rain forest.

4. Depletion of Fresh Ground Water:

Most of the irrigation in dry areas of Punjab, Haryana and Western Uttar Pradesh was carried out by excessive use of ground water. Today fresh ground water situation in these states is alarming. In the coming few years if this type of farming practice continues, these states are going to face water famine.

5. Adverse impact of Global Climatic Change:

Among various challenges, global climatic change is the recent one. It is predicted that due to climate change, temperature would increase from 2°C to 3°C, there would be increase in sea level, more intense cyclones, unpredictable rainfall etc These changes would adversely affect the production of crops.

6. Impact of Globalization:

We can see the effect of globalization on the farm sector in India. All developing countries have been affected by it. The most evident effect is the squeeze on farmer ‘s income and the threat to the viability of cultivation in India. This is due to the rising input costs and falling output prices. This reflects the combination of reduced subsidy and protection to farmers.

7. Providing Food Security:

Before the introduction of green revolution in India, we were not self-sufficient in terms of our food grain production. With the introduction of green revolution, production of food grains increased substantially and India became self-sufficient. However, during the last one decade the total production has become stagnant. On the other hand, we have added another 16 to 18 million populations over this period. Although India has become self-sufficient in good it is yet to ensure food security which is dependent upon accessibility, affordability as well nutritional value of the food available. One of the biggest challenges facing India is Providing Food Security to its population.

3.11 METHODS OF SOWING:

The sowing method is determined by the crop to be sown. There are 6 sowing methods which differ in their merits, demerits and adoption. Those are:

1) **Broad casting**: It is the scattering of seeds by hand all over the prepared field followed by covering with wooden plank or harrow for contact of seed with soil. Crops like wheat, paddy, Sesamum, methi, etc. are sown by this method.

♣ Advantages:

a) Quickest & cheapest method
b) Skilled labor is not required.
c) Followed in moist condition.

♣ Disadvantages:

a) Seed requirement is more.
b) Crop is not uniform.
c) Results in gap in germination & defective wherever the adequate moisture is not present in the soil.
d) Spacing is not maintained within rows & lines.

2) **Drilling or Line sowing**: It is the dropping of seeds into the soil with the help of implement such as mogha, seed drill, seed-cum-ferti driller or mechanical seed drill and then the seeds are covered by wooden plank or harrow to have contact between seed & soil. Crops like Jowar, wheat Bajara, etc. are sown by this method.

♣ Advantages:

a) Seeds are placed at proper & uniform depths
b) Along the rows, interculturing can be done
c) Uniform row to row spacing is maintained
d) Seed requirement is less than _broad casting ‘
e) Sowing is done at proper moisture level

3) **Dibbling:** It is the placing or dibbling of seeds at cross marks (+) made in the field with the help of maker as per the requirement of the crop in both the directions. It is done manually by dibbler. This method is followed in crops like Groundnut, Castor, Cotton, etc. which are having bold size and high value.

♣ Advantages:

a) Spacing between rows & plants is maintained
b) Seeds can be dibbled at desired depth in the moisture zone
c) Optimum plant population can be maintained
d) Seed requirement is less than other method
e) Implement is not required for sowing
f) An intercrop can be taken in wider spaced crops
g) Cross wise intercultivation is possible

♣ Disadvantages:

a) Laborious & time-consuming method
b) Require more labour, hence increase the cost of cultivation
c) Only high value & bold seeds are sown
d) Require strict supervision.

4) **Transplanting:** It is the raising of seedlings on nursery beds and transplanting of seedlings in the laid-out field. For this, seedlings are allowed to grow on nursery beds for about 3-5 weeks. Beds are watered one day before the transplanting of nursery to prevent jerk to the roots. The field is irrigated before actual transplanting to get the seedlings established early & quickly which reduce the mortality. Besides the advantages & disadvantages of dibbling method, initial cost of cultivation of crop can be saved but requires due care in the nursery. This method is followed in crops like paddy, fruit, vegetable, crops, tobacco, etc.

5) **Planting:** It is the placing of vegetative part of crops which are vegetatively propagated in the laid-out field. E.g.: Tubers of Potato, mother sets of ginger & turmeric, cuttings of sweet potato & grapes, sets of sugarcane.

6) **Sowing behind the plough:** Sowing behind the plough is done by manual or mechanical means. Seeds are dropped in the furrows opened by the plough and the same is closed or covered when the next furrow is opened. The seeds are sown at uniform distance. Manual method is a laborious and time-consuming process. Seeds like red gram, cowpea and groundnut are sown behind the country plough. Major sown crop is ground out. Seeds are sown by mechanical means by Gorus – seed drill. A seed drill has a plough share and hopper. Seeds are placed on hopper.

Some other forms of sowing are:

- Row planting: Mark the placement of a row within your garden, and then make a furrow at the correct depth along the row. Some seeds may not sprout, so sow seeds more thickly than you want the final spacing of the crops to be. Thinning rows is less of a chore if you space seeds as evenly as possible. Cover the seeds with fine soil and then firm them in with the back of a hoe to make sure that all the seeds are in contact with the soil. Water gently. If you plan to use furrow irrigation, fill the furrows with water first and then push the large seeds into the top of raised beds.

- Wide row planting: This method allows you to plant more seeds in less space by concentrating watering, weeding, and fertilizing in a smaller area. Rows are generally 10 to 16 inches (25 to 41 cm) wide. Sprinkle seeds over the entire row — with most crops, try to land the seeds about 1/2 to 1 inch (1 to 2 cm) apart. For peas and beans, space them 1-1/2 to 2 inches (4 to 5 cm). Cover small seeds with a thin layer of potting soil. Lightly pat the potting soil down again to bring the added soil into firm contact with the seeds.

- Bed planting: Planting in beds is essentially the same as planting wide rows.

- Hill planting: Plant seeds for vining crops that spread out, such as squash, melons, or cucumbers, in hills or circular groups. Loosen the soil in a 1-foot-diameter (30 cm) area, level the area, and then plant five to six seeds close together. Thin out all but the two strongest seedlings.

Space for The Seedlings

Frequently, plant quality suffers from crowding too many plants into a small area. Crowded seedlings become weak and spindly and are more susceptible to disease. Wider spacing permits stronger growth. To produce high quality plants, space them so that the leaves of one plant do not touch those of another. For maintaining spacing between the crops tinning and filling is needed.

3.12 WELDING:

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the workpieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. This is in contrast with soldering and brazing, which involve melting a lower-melting-point material between the workpieces to form a bond between them, without melting the work pieces.

3.12.1 Some of the best-known welding methods include:

1. Shielded metal arc welding (SMAW) - also known as "stick welding", uses an electrode that has flux, the protectant for the puddle, around it. The electrode holder holds the electrode as it slowly melts away. Slag protects the weld puddle from atmospheric contamination.
2. Gas tungsten arc welding (GTAW) - also known as TIG (tungsten, inert gas), uses a non-consumable tungsten electrode to produce the weld. The weld area is protected from atmospheric contamination by an inert shielding gas such as 0or Helium.
3. Gas metal arc welding (GMAW) - commonly termed MIG (metal, inert gas), uses a wire feeding gun that feeds wire at an adjustable speed and flows an argon-based shielding gas or a mix of argon and carbon dioxide (CO_2) over the weld puddle to protect it from atmospheric contamination.
4. Flux-cored arc welding (FCAW) - almost identical to MIG welding except it uses a special tubular wire filled with flux; it can be used with or without shielding gas, depending on the filler.
5. Submerged arc welding (SAW) - uses an automatically fed consumable electrode and a blanket of granular fusible flux. The molten weld and the arc zone are protected from atmospheric contamination by being "submerged" under the flux blanket.
6. Electroslag welding (ESW) - a highly productive, single pass welding process for thicker materials between 1 inch (25 mm) and 12 inches (300 mm) in a vertical or close to vertical position.

Many different energy sources can be used for welding, including a gas flame, an electric arc, a laser, an electron beam, friction, and ultrasound. While often an industrial process, welding may be performed in many different environments, including in open air, under water and in outer space. Welding is a hazardous undertaking and precautions are required to avoid burns, electric shock, vision damage, inhalation of poisonous gases and fumes, and exposure to intense ultraviolet radiation.

3.12.2 Arc welding

These processes use a welding power supply to create and maintain an electric arc between an electrode and the base material to melt metals at the welding point. They can use either direct (DC) or alternating (AC) current, and consumable or non-consumable electrodes. The welding region is sometimes protected by some type of inert or semi-inert gas, known as a shielding gas, and filler material is sometimes used as well.

Power supplies:

To supply the electrical power necessary for arc welding processes, a variety of different power supplies can be used. The most common welding power supplies are constant current power supplies and constant voltage power supplies. In arc welding, the length of the arc is directly related to the voltage, and the amount of heat input is related to the current. Constant current power supplies are most often used for manual welding processes such as gas tungsten arc welding and shielded metal arc welding, because they maintain a relatively constant current even as the voltage varies. This is important because in manual welding, it can be difficult to hold the electrode perfectly steady, and as a result, the arc length and thus voltage tend to fluctuate. Constant voltage power supplies hold the voltage constant and vary the current, and as a result, are most often used for automated welding processes such as gas metal arc welding, flux cored arc welding, and submerged arc welding. In these processes, arc length is kept constant, since any fluctuation in the distance between the wire and the base material is quickly rectified by a large change in current. For example, if the wire and the base material get too close, the current will rapidly increase, which in turn causes the heat to increase and the tip of the wire to melt, returning it to its original separation distance.

The type of current used plays an important role in arc welding. Consumable electrode processes such as shielded metal arc welding and gas metal arc welding generally use direct current, but the electrode can be charged either positively or negatively. In welding, the positively charged anode will have a greater heat concentration, and as a result, changing the polarity of the electrode has an impact on weld properties. If the electrode is positively charged, the base metal will be hotter, increasing weld penetration and welding speed. Alternatively, a negatively charged electrode results in more shallow welds. Non consumable electrode processes, such as gas tungsten arc welding, can use either type of direct current, as well as alternating current. However, with direct current, because the electrode only creates the arc and does not provide filler material, a positively charged electrode causes shallow welds, while a negatively charged electrode makes deeper welds. Alternating current rapidly moves between these two, resulting in medium-penetration welds. One disadvantage of AC, the fact that the arc must be re-ignited after every zero crossing, has been addressed with the invention of special power units that produce a square wave pattern instead of the normal sine wave, making rapid zero crossings possible and minimizing the effects of the problem.

Common Processes:

One of the most common types of arc welding is shielded metal arc welding (SMAW); it is also known as manual metal arc welding (MMA) or stick welding. Electric current is used to strike an arc between the base material and consumable electrode rod, which is made of filler material (typically steel) and is covered with a flux that protects the weld area from oxidation and contamination by producing carbon dioxide (CO_2) gas during the welding process. The electrode core itself acts as filler material, making a separate filler unnecessary.

3.12.3 Shielded metal arc welding:

The process is versatile and can be performed with relatively inexpensive equipment, making it well suited to shop and field work. An operator can become reasonably proficient with a modest amount of training and can achieve mastery with experience. Weld times are rather slow, since the consumable electrodes must be frequently replaced and because slag, the residue from the flux, must be chipped away after welding. Furthermore, the process is generally limited to welding ferrous materials, though special electrodes have made possible the welding of cast iron, nickel, aluminium, copper, and other metals.

Diagram of arc and weld area, in shielded metal arc welding:
1. Coating Flow
2. Rod
3. Shield Gas
4. Fusion
5. Base metal
6. Weld metal
7. Solidified Slag

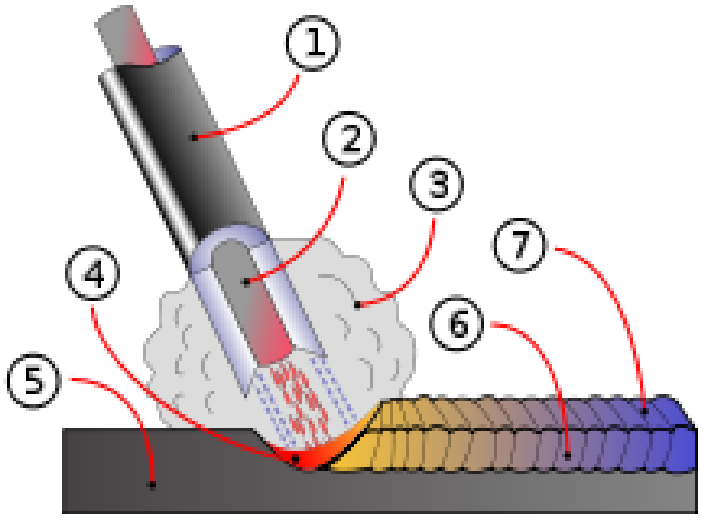


Fig 3.7: Shielded metal arc welding

3.13 CONTROLLER CIRCUIT:

COMPONENTS USED

- IC LM317
- Transistor BD 139
- Diode (6A4 x3 ,1N4007)
- Zener diode (11.0V)
- Capacitor (470)Ω, 240 Ω, 2.2K Ω x 2, 100
- Resistor (1K PotentiometerΩ
- Relay 12V,10A

WORKING

- If the battery voltage is below 12V, then the current from LM317 IC flows through the resistor R5 and diode D5 to the battery. At this time, Zener diode D6 will not conduct because battery takes all the current for charging.
- When the battery voltage rises to 13.5V, the current flow to the battery stops and Zener diode gets the sufficient breakdown voltage and it allows the current through it.
- Now the base of the transistor gets the sufficient current to turn on so that the output current from LM317 voltage regulator is grounded through the transistor Q1.

3.14 ARDUINO:

Arduino UNO has an USB interface. The chip on the board plugs straight into your USB port and registers on your computer as a virtual serial port. This allows you to interface with it as through it were a serial device. The benefit of this setup is that serial communication is an extremely easy (and time-tested) protocol, and USB makes connecting it to modern computers really convenient.

Very convenient power management and built-in voltage regulation. It is possible to connect an external power source of up to 12v and it will regulate it to both 5v and 3.3v. It also can be powered directly off of a USB port without any external power. It has countless number of nice hardware features like timers, PWM pins, external and internal interrupts, and multiple sleep modes. A 16 MHz clock. This makes it not the speediest microcontroller around, but fast enough for most applications.32 KB of flash memory for storing your code. 13digital pins and 6 analog pins.

These pins allow the user to connect external hardware to the Microcontroller. These pins are key for extending the computing capability of the Microcontroller into the real world. Simply plug the devices and sensors into the sockets that correspond to each of these pins.

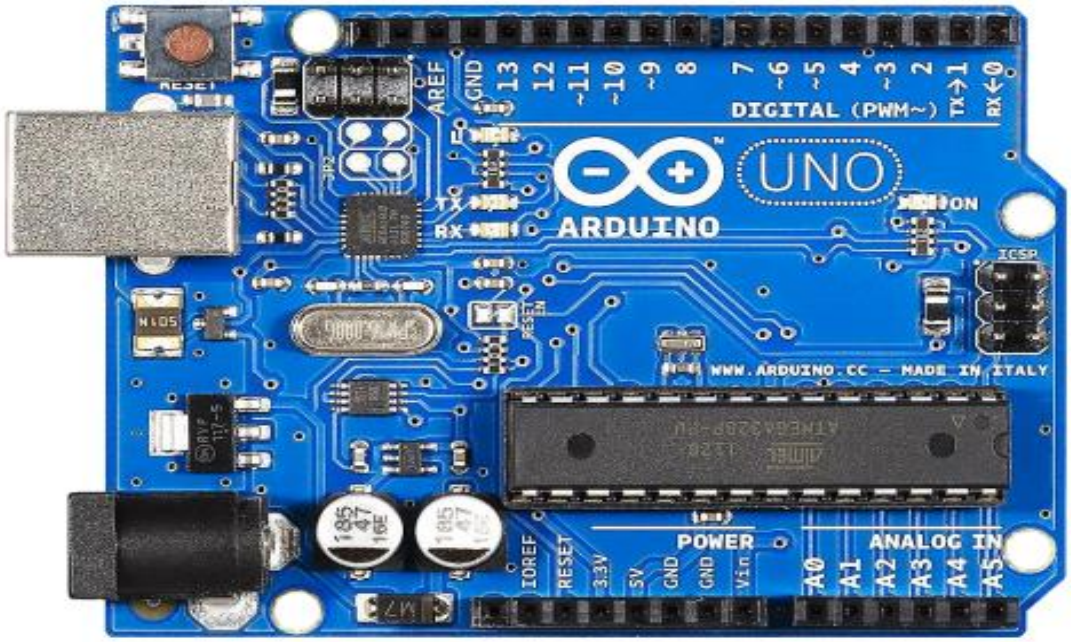


Fig 3.8: Arduino UNO circuit board

Very convenient power management and built-in voltage regulation. It is possible to connect an external power source of up to 12v and it will regulate it to both 5V and 3.3V. It also can be powered directly off of a USB port without any external power. It has countless number of nice hardware features like timers, PWM pins, external and internal interrupts, and multiple sleep modes. A 16 MHz clock. This makes it not the speediest microcontroller around, but fast enough for most applications 32 KB of flash memory for storing your code. 13 digital pins and 6 analog pins.

These pins allow the user to connect external hardware to the Microcontroller. These pins are key for extending the computing capability of the Microcontroller into the real world. Simply plug the devices and sensors into the sockets that correspond to each of these pins.

The high-performance, low-power Atmel 8-bit AVR RISC-based microcontroller combines 16KB ISP flash memory, 1KB SRAM, 512B EEPROM, an 8-channel/10-bit A/D converter (TQFP and QFN/MLF), and debug WIRE for on-chip debugging. The device supports a throughput of 20 MIPS at 20 MHz and operates between 2.7-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves through outputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

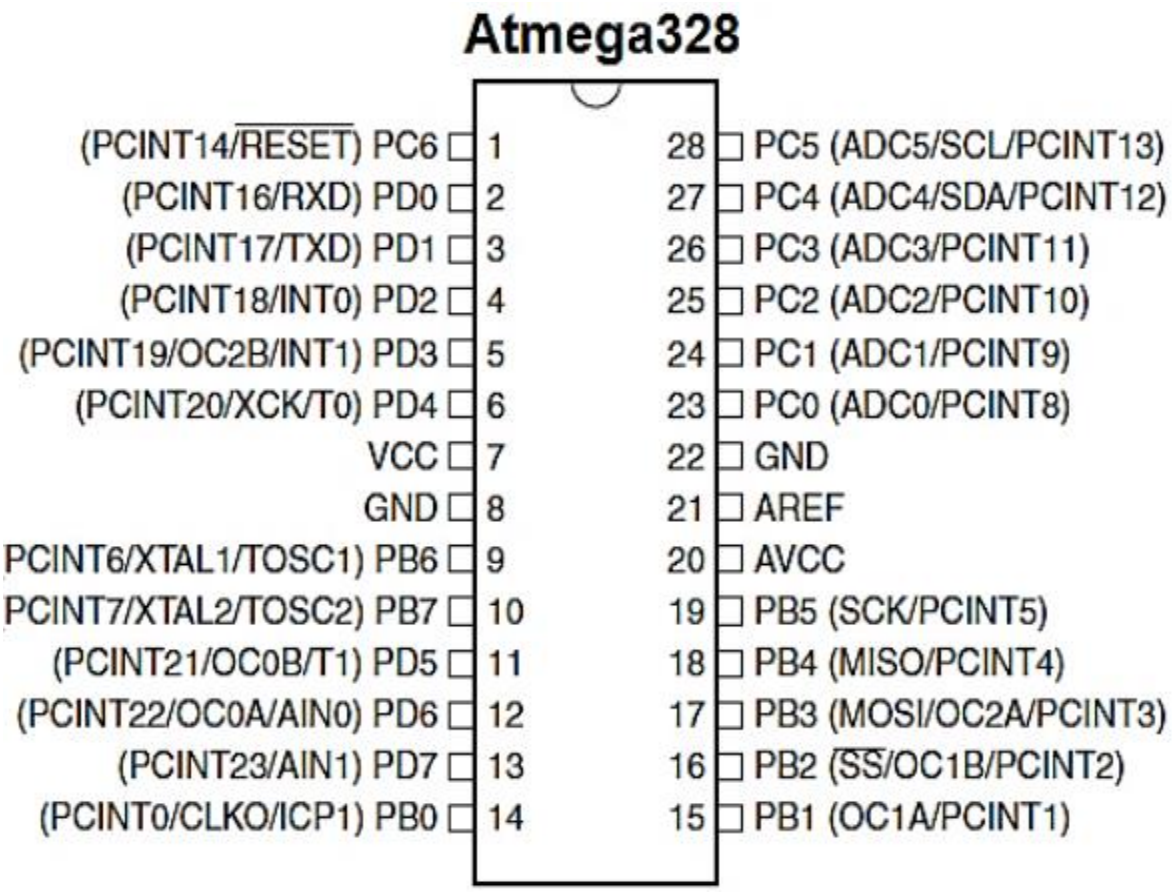


Fig 3.9: ATMEGA 328 architecture

3.15 MOTOR DRIVER IC:

L293D is a typical Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. There are 4 input pins for l293d, pin 2,7 on the left and pin 15 ,10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right-hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC 1.

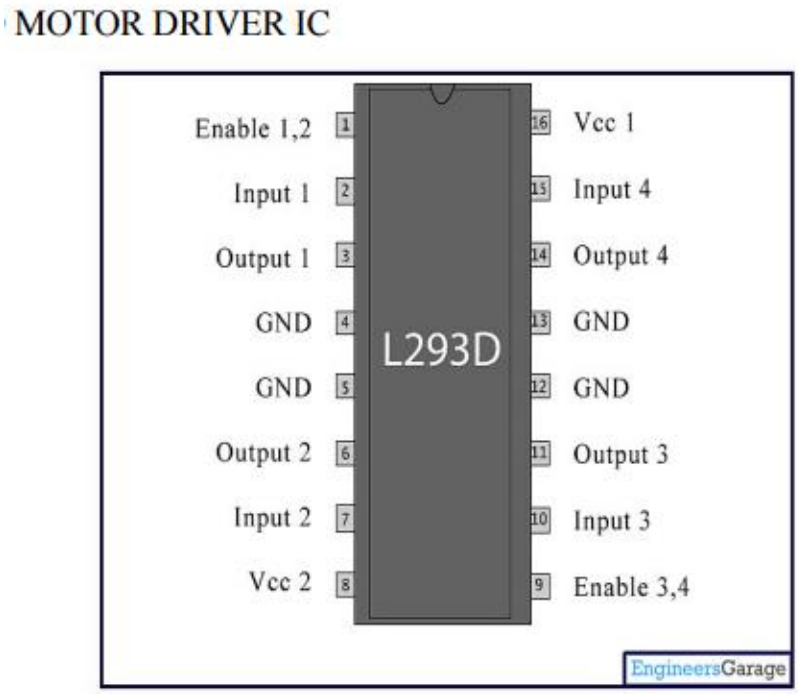


Fig 3.10: Motor Driver IC

3.16 Wi-Fi module ESP8266:

ESP8266 has 8 pins, 4 in the row of 2. The rst(reset) pin on the top left is GND. The two pins right from the GND are GPIO 2 and 0. The pin on the top right side is the RX pin and the pin on the lower left is TX. These are the pins for communication. The middle pins on the bottom are CH-PD (chip power-down) and RST (reset). The main thing to remember is this device works with 3.3V, even the RX and TX pins. Arduino or many USB to serial converters work with 5V. The solution for this project is in the next step.

Fig 3.11: WiFi module

3.17 Relay:

A relay is an electrically operated switch. Several relays use a magnet to automatically operate a switch, however alternative in operation principles are used, like solid state relays. Relays are used wherever it's necessary to regulate a circuit by a separate low-power signal, or wherever many circuits should be controlled by one signal. The essential relays were handling in long distance communicate circuits as amplifiers, they unbroken the signal coming back in from one circuit and re-transmitted it on another circuit.

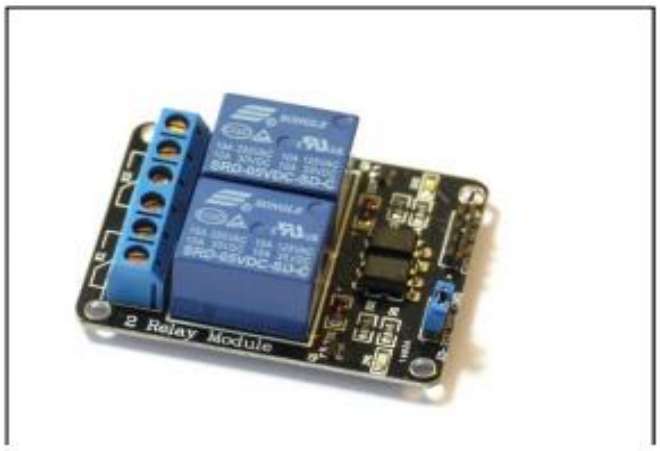


Fig 3.12: Relay circuit

3.18 Motor Driver L293D:

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that we can control more than two DC motor with a single L293D IC at same time.

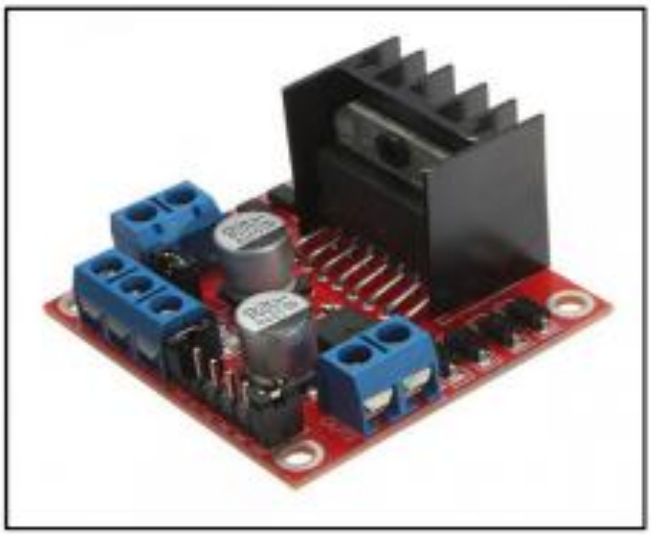


Fig 3.13: Motor driver IC

3.19 Alf-Egil Bogen Vegard Wollan RISC (AVR) Microcontroller:

AVR was developed in the year 1996 by Atmel Corporation. The architecture of AVR was developed by Alf-Egil Bogen and Vegard Wollan. AVR derives its name from its developers and stands for Alf-Egil Bogen Vegard Wollan RISC microcontroller, also known as Advanced Virtual RISC. The AT90S8515 was the first microcontroller which was based on AVR architecture however the first microcontroller to hit the commercial market was AT90S1200 in the year 1997.

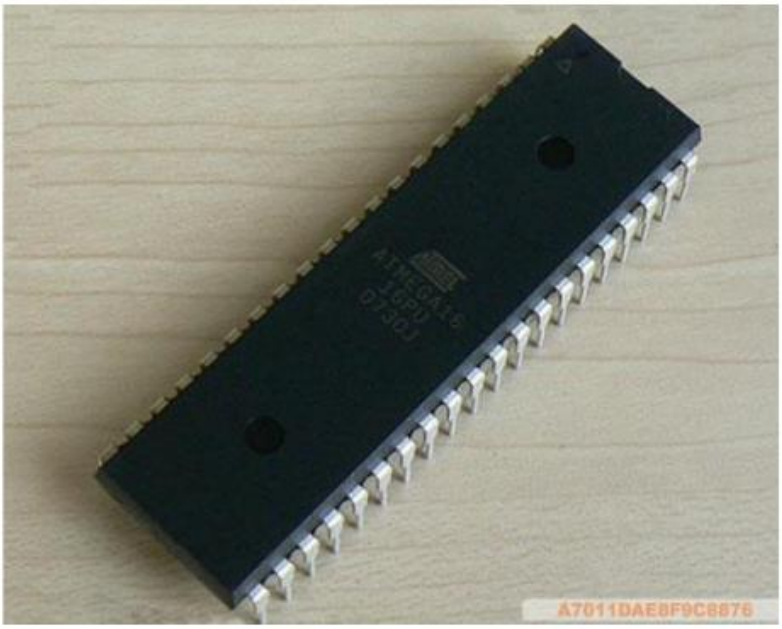


Fig : AVR Microcontroller

Fig 3.14

AVR microcontrollers are available in three categories:

1. Tiny AVR – Less memory, small size, suitable only for simpler applications
2. Micro AVR – These are the most popular ones having good amount of memory (up to 256 KB), higher number of inbuilt peripherals and suitable for moderate to complex applications.
3. Mega AVR – Used commercially for complex applications, which require large program memory and high speed.

3.20 MAJOR SOFTWARE REQUIRED:

Arduino Software (IDE): The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. This software can be used with any Arduino board. For latest software refer to link: https://www.arduino.cc/en/Main/Software

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students with or without a background in electronics and programming.

Arduino is an open-source prototyping platform based on easy-to-use hardware and software.

Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a message - and turn it into an output - activating a motor, turning on an LED, publishing

You can tell your board what to do by sending a set of instructions to the microcontroller on the board.

To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Advantages of using Arduino Software (IDE):

- Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. Cross-platform
- The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows. Simple, clear programming environment
- The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well.
- Open source and extensible hardware - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it.
- Open source and extensible software - The Arduino software is published as open source tool and the language can be expanded through C++ libraries.

3.21 How to use Arduino IDE Tool (Steps for using Arduino IDE):

Step 1: Get an Arduino board and USB cable:

For using an Arduino UNO we also need a standard USB cable (A plug to B plug): the kind used to connect to a USB printer, for example.

Step 2: Download the Arduino environment:

https://www.arduino.cc/en/Main/Software - Get the latest version from the download page. When the download finishes, unzip the downloaded file. Make sure to preserve the folder structure. Double-click the folder to open it. There should be a few files and sub-folders inside.

Step 3: Connect the board:

The Arduino Uno, Mega, Duemilanove and Arduino Nano automatically draw power from either the USB connection to the computer or an external power supply. If we're using an Arduino Diecimila, we'll need to make sure that the board is configured to draw power from the USB connection. The power source is selected with a jumper, a small piece of plastic that fits onto two of the three pins between the USB and power jacks. Check that it's on the two pins closest to the USB port. Connect the Arduino board to your computer using the USB cable. The green power LED (labelled PWR) should go on.

Step 4: Install the drivers:

Installing drivers for the Arduino Uno or Arduino Mega 2560 with Windows7, Vista, or XP

Step 5: Launch the Arduino application:

Double-click the Arduino application. (Note: if the Arduino software loads in the wrong language, we can change it in the preferences dialog).

Step6: Open the blink example:

Open the LED blink example sketch: File > Open > Temp_and_humid.ino

Step 7: Select your board:

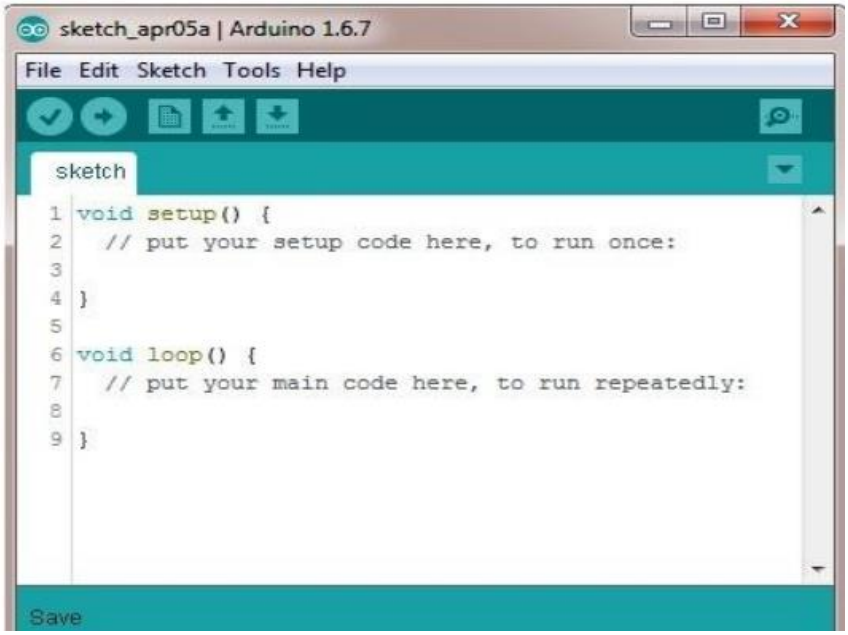
We need to select the entry in the Tools > Board menu that corresponds to your Arduino.

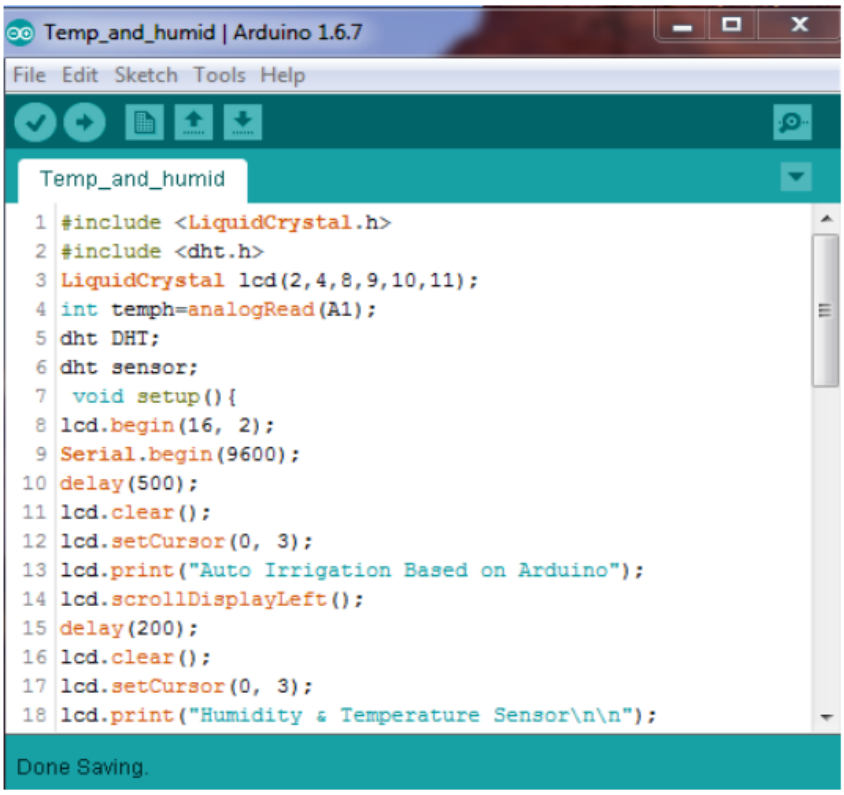
Step 8: Select your serial port:

Select the serial device of the Arduino board from the Tools | Serial Port menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your Arduino board and re-open the menu; the entry that disappears should be the Arduino board. Reconnect the board and select that serial port.

Step 9: Upload the program:

Now, simply click the "Upload" button in the environment. Wait a few seconds - you should see the RX and TX led on the board flashing. If the upload is successful, the message "Done uploading." will appear in the status bar.





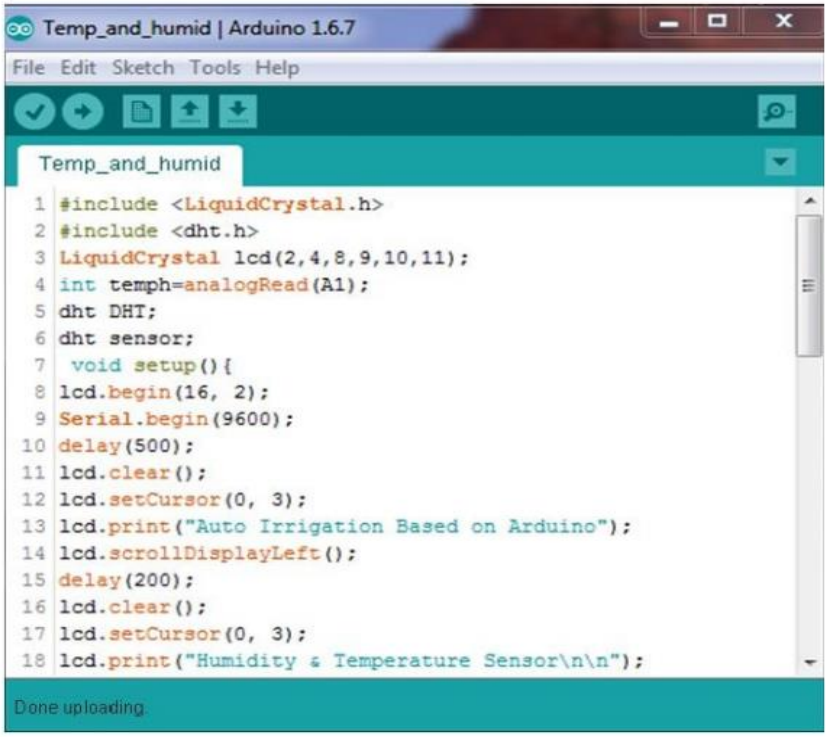


Fig 3.15: Arduino application interface

3.22 EMBEDDED C:

Embedded C is a set of language extensions for the C Programming language. C is often used for system programming, including implementing applications. Embedded C uses most of the syntax of standard C, e.g., main() function, variable definition, data type declaration, conditional statements (if, switch, case), loops (while, for), functions, arrays and strings, structures etc. It is small and simpler to learn, understand, program and debug. It is efficient & supports access to I/O and provides ease of management of large embedded projects. The compiler derives its name from the way it works, looking at the entire piece of source code and collecting and reorganizing the instruction. See there is a bit little difference between compiler and an interpreter. Interpreter just interprets whole program at a time while compiler analyses and execute each line of source code in succession, without looking at the entire program

Advantages of Embedded C:

1. It is small and simpler to learn, understand, program and debug.
2. Compared to assembly language, C code written is more reliable and scalable, more portable between different platforms.
3. C compilers are available for almost all embedded devices in use today, and there is a large pool of experienced C programmers.

4. Unlike assembly, C has advantage of processor-independence and is not specific to any particular microprocessor/microcontroller or any system. This makes it convenient for a user to develop programs that can run on most of the systems.
5. As C combines functionality of assembly language and features of high-level languages, C is treated as a „middle-level computer language" or „high level assembly language".
6. It is fairly efficient.
7. It supports access to I/O and provides ease of management of large embedded projects.
8. Java is also used in many embedded systems but Java programs require the Java Virtual Machine (JVM), which consumes a lot of resources. Hence it is not used for smaller embedded devices.

CHAPTER 4

DESIGN AND FABRICATION OF MULTIPURPOSE ARGICULTURAL VEHICLE

4.1 Objective:

The purpose of this project is to provide farmer with multipurpose equipment which implements all the scientific farming specifications and technology to get maximum yield and good quality crops by reducing investment and number of labors. There are many tractors powered equipment which are suitable and economical only for more than 5 acres of land. There are many hands pulled equipment which are only suitable for gardening purpose. Our objective of making animal powered equipment is suitable for 1 acre to 3 acres of land it is both economical and modernized with scientific methods. Majority of the Indian formers are the land owners of 1 to 3 acres. Hence it is most suitable for Indian economy and farming techniques.

4.2 Factors That Influenced Design and Fabrication of Our Equipment:

- Scientific farming methods
- Precision farming
- Acceptance for all types of seed to seed farming
- Fool proofing
- Portability of the equipment: our equipment is completely flexible for easy assembly and disintegration.
- Low cost

4.3 VARIOUS CALCULATIONS

4.3.1 Calculation for Plough:

Depth of cut= 5 cm
Speed of the tool= 2.5 km/hr. = 41.66 m/hr.
No. of tool= 4
Feed rate= Rpm x N x CL
FR= 41.66x4x0.05 Feed rate
R= 8.332 m2 /min

4.3.2 Tool Life Calculation from Taylor's tool life equation:

$$vTn = C$$

Where,
v= velocity
T= tool life C,
n= Taylor coefficient for HSS,
n=0.2 V= 41.6 m/min 41.6xT^n=100
T= 2.4x10^20cycles for mild steel,
T= 2.4x10^10 cycles

4.3.3 Calculation for seed sowing:

Speed of the motor= 30 rpm
Row spacing= 22 cm
Seed sowing time= 2 sec/per seed
No. of openings = 4 Seed dropping per minute = 30x4 = 120 seeds
If the speed of the wheel is 42 m/min, then for 42-meter 120 seeds are dropped.

4.3.4 Bending Stress Calculation of the Axle Shaft:

Consider the weight of 1500 N is acting on the shaft,
Induced stress, $\sigma = M/Z$
Moment, M = (WL)/4
Where, W = load; L = Length
M = (1500 * 1100)/4
M = 412500 N/mm
Section modulus, $z = (\pi/16) * d3$
Z = (3.14/16) * 353
Z = 8414.21 mm3 σ = (412500/8414.21)
σ = 49.02 N/mm2
Therefore, Induced stress < Allowed stress 49.02 N/mm2 < 270 N/mm2
(Hence the design is safe).

CONCLUSION

This multipurpose system gives an advance method to sow, plow and cut the crops with minimum man power and labor, making it an efficient vehicle and eco-friendly vehicle using solar system and cell phone controlled. The machine will cultivate the farm by considering particular rows and specific column at fixed distance depending on crop which is controlled manually by the driver for a particular distance.

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FUTURE SCOPE OF THIS PROJECT:

- We can interface sensors to this Machine′ so that it can monitor some parameters.
- We Can add More Drill for different′ crops.
- We can add fertilizer tank in′ Machine to reduce more efforts.
- There are to be proper provisions are′ needed to couple the machine with the tractor.

COST ESTIMATION

1. MATERIAL COST:

SL. NO.	NAME OF THE PARTS	MATERIAL	QUANTITY	AMOUNT (RS)
1	Frame work	MS	1	3200/-
2	wheels	MS	2	1600/-
3	bushes	M.S	2	160/-
4	battery	Lead acid battery	1	900/-
5	Lead screw	M.S	1	400/-
6	MS plate	MS	1	100/-
7	Solar panel		1	900/-
8	shaft	MS	1	650/-
9	Ball bearing	ss	6	780/-
10	funnel	GI	2	480/-
11	Dc motor		3	2550/-
12	Sub pump		1	180/-
13	Bluetooth controller			2500/-

ESTIMATED COST = 14450/-

2. LABOUR COST:

LATHE, DRILLING, WELDING, GRINDING, POWER HACKSAW, GAS CUTTING:

Cost =

3. OVERHEAD CHARGES:

The overhead charges are arrived by “Manufacturing cost”

Manufacturing Cost = Material Cost + Labour cost

=

Overhead Charges = 20% of the manufacturing cost

=

TOTAL COST

Total cost = Material Cost + Labour cost + Overhead Charges

=

=

Total cost for this project =