



IJARST

International Journal For Advanced Research In Science & Technology

A peer reviewed international journal

www.ijarst.in

ISSN: 2457-0362

Arduino Based Smart Agriculture System

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Abstract- An embedded system can be defined as a computing device that does a specific focused job. Appliances such as the air-conditioner, VCD player, DVD player, printer, fax machine, mobile phone etc, are examples of embedded systems. Each of these appliances will have a processor and special hardware to meet the specific requirement of the application along with the embedded software that is executed by the processor for meeting that specific requirement. The embedded software is also called “firm ware”. The desktop /laptop computer is a general purpose computer. You can use it for a variety of applications such as playing games, word processing, accounting, software development and so on. Embedded systems do a very specific task; they cannot be programmed to do different things. Embedded systems have very limited resources, particularly the memory. Generally, they do not have secondary storage devices such as the CDROM or the floppy disk. Embedded systems have to work against some deadlines. A specific job has to be completed within a specific time. In some embedded systems, called real-time systems, the deadlines are stringent. Missing a deadline may cause a catastrophe-loss of life or damage to property. Embedded systems are constrained for power. As many embedded systems operate through a battery, the power consumption has to be very low. Some embedded systems have to operate in extreme environmental conditions such as very high temperatures and humidity..

Index Terms- Embedded system, VCD player, DVD player, printer, fax machine, mobile phone

I. INTRODUCTION

Generally most of the irrigation systems are manually operated one. These traditional techniques are being replaced with semi-automated and automated techniques suggested an automated concept of irrigation to use the water efficiently and effectively Automated Drip Irrigation system is implemented either based on the soil humidity or based on the user input via SMS commanding systems. Former method is an isolated irrigation system where the farmer doesn't updated with the irrigation status and later lags in smart utilization of water due to user command without considering the condition of soil. From that ever growing requirement of the population, modern techniques are introduced to control the system. To give proper attention to the land located far away from the human settlement, supervisory automatic control systems like multi-terminal control systems are used since in many processes, factors like soil, salinity, irrigation, temperature, light intensity, etc. needs repeated tasks and have to work in abnormal environmental conditions of the soil and to overcome the flaws in the existing system here we are irrigating the land based on the soil humidity and at the same time the status of the irrigation is updated wirelessly to Server via serial Communication. With this farmers are intimated about fertilizers required for the crops for better yield at various conditions by measuring soil nature and the better crop cultivation based on the climatic conditions. That leads to flexibility in monitoring the irrigation system at anywhere provided with internet. The server side data can be retrieve via the internet to access it for easy to handle the devices and now a days internet is also necessity for all human beings then only it will become a booming to continuous monitoring and controlling of irrigation system. The soil moisture sensors which are nothing but copper strands are inserted in the soil. The soil sensing arrangement measures the conductivity of the soil. Wet soil will be more conductive than dry soil. The soil sensing arrangement module has a comparator in it. The voltage from the prongs and the predefined voltage are compared and the output of the comparator is high only when the soil condition is dry. This output from the soil sensing arrangement is given to the analogue input pin of the microcontroller. The microcontroller continuously monitors the analogue input pin. When the moisture in the soil is above the threshold, the microcontroller displays a message mentioning the same and the motor is off. When the output from the soil sensing arrangement is high i.e. the moisture of the soil is less.Arduino is a computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides



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an integrated development environment (IDE) based on the Processing language project. The Arduino project started in 2005 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors. The name Arduino comes from a bar in Ivrea, Italy, where some of the founders of the project used to meet. The bar was named after Arduin of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014. The origin of the Arduino project started at the Interaction Design Institute Ivrea (IDII) in Ivrea, Italy. At that time, the students used a BASIC Stamp microcontroller at a cost of \$100, a considerable expense for many students. In 2004, Colombian student Hernando Barragán created the development platform wiring as a Master's thesis project at IDII, under the supervision of Massimo Banzi and Casey Reas, who are known for work on the Processing language. The project goal was to create simple, low cost tools for creating digital projects by non-engineers. The Wiring platform consisted of a printed circuit board (PCB) with an ATmega168 microcontroller, an IDE based on Processing and library functions to easily program the microcontroller. In 2005, Massimo Banzi, with David Mellis, another IDII student, and David Cuartielles, added support for the cheaper ATmega8 microcontroller to Wiring. But instead of continuing the work on Wiring, they copied the Wiring source code and renamed it as a separate project, called Arduino. The initial Arduino core team consisted of Massimo Banzi, David Cuartielles, Tom Igoe, Gianluca Martino, and David Mellis, but Barragán was not invited to participate. Following the completion of the Wiring platform, lighter and less-expensive versions were distributed in the open-source community. Adafruit Industries, a New York City supplier of Arduino boards, parts, and assemblies, estimated in mid-2011 that over 300,000 official Arduinos had been commercially produced, and in 2013 that 700,000 official boards were in users' hands.

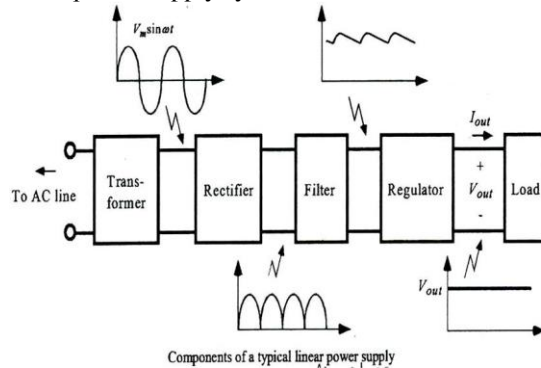
Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available. The source code for the IDE is released under the GNU General Public License, version 2. Nevertheless, an official Bill of Materials of Arduino boards has never been released by Arduino staff. An Arduino board consists of an Atmel 8, 16 or 32-bit AVR microcontroller but other makers' microcontrollers have been used since 2015. The boards use single-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed shields. Multiple, and possibly stacked shields may be individually addressable via an I²C serial bus. Most boards include a 5V linear regulator and a 16 MHz crystal oscillator or ceramic resonator. Some designs, such as the Lily Pad, run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions.

Arduino/Genuino Uno has a number of facilities for communicating with a computer, another Arduino/Genuino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer. A Software Serial library allows serial communication on any of the Uno's digital pins. The ATmega328 also supports I²C (TWI) and SPI communication. The Arduino Software (IDE) includes a Wire library to simplify use of the I²C bus; see the documentation for details. For SPI communication, use the SPI library. Rather than requiring a physical press of the reset button before an upload, the Arduino/Genuino Uno board is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino Software (IDE) uses this capability to allow you to upload code by simply pressing the upload button in the interface toolbar. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload. This setup has other implications. When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data. The Uno board contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line.

LCD DISPLAY: To display the status of the project we require a display unit to display the status of the project. So in our project we used 16x2 LCD display. LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The data pins connected to the port pins (p2.2-p2.5) take the data or command lines that are given by programming and displays the data that is available on the data lines. It indicates the status of the circuit weather the RFID scanned is

matched or not. If the RFID is matched then at the same time the LCD displays the comment. The potentiometer to the VEE pins to adjust the contrast of the LCD. The RS pin is connected to p2.0.

The power supply is designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can be broken down into a series of blocks, each of which performs a particular function. A dc power supply which maintains the output voltage constant irrespective of ac mains fluctuations or load variations is known as “Regulated D.C Power Supply”. For example a 5V regulated power supply system as shown below:



The purpose of a rectifier is to convert an AC waveform into a DC waveform. There are two different rectification circuits, known as 'half-wave' and 'full-wave' rectifiers. Both use components called diodes to convert AC into DC.

FILTER: A Filter is a device, which removes the ac component of rectifier output but allows the dc component to reach the load.

CAPACITOR FILTER: We have seen that the ripple content in the rectified output is high. Such high percentages of ripples are not acceptable for most of the applications. Ripples can be removed by one of the following methods of filtering: A capacitor, in parallel to the load, provides an easier by –pass for the ripples voltage though it due to low impedance. At ripple frequency and leave the d.c.to appears the load. Filtering is performed by a large value electrolytic capacitor connected across the DC supply to act as a reservoir, supplying current to the output when the varying DC voltage from the rectifier is falling. The capacitor charges quickly near the peak of the varying DC, and then discharges as it supplies current to the output. Filtering significantly increases the average DC voltage to almost the peak value ($1.4 \times \text{RMS value}$). The output of the capacitive filter is pure DC voltage. This voltage is connected to the components that require 12V DC supply directly by a connecting wire. On the other side the output of the filter is fed to the voltage regulator.

REGULATOR: While there are many circuits that will tolerate a smoothed power supply, some must have a completely regular supply with no ripple voltage. Voltage regulator IC can be define as an integrated circuit that is capable of supplying a constant controlled output voltage which is not at all affected by the variations in input voltage provided that the variations are within the prescribed limits under specified atmospheric conditions. Voltage fluctuations may damage or reduce the life of circuit components. Usage of voltage regulator ICs helps in avoiding such events by maintaining voltage at the required levels. Regulators are manufactured in two series.

Global System for Mobile Communication (GSM) Definition: GSM, which stands for Global System for Mobile communications, reigns (important) as the world’s most widely used cell phone technology. Cell phones use a cell phone service carrier’s GSM network by searching for cell phone towers in the nearby area. Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz. It is estimated that many countries outside of Europe will join the GSM partnership.



GSM module



II. EXISTING WORK OR LITERATURE SURVEY

The Base Station Subsystem is composed of two parts, the Base Transceiver Station (BTS) and the Base Station Controller (BSC). These communicate across the specified Abis interface, allowing (as in the rest of the system) operation between components made by different suppliers. The Base Transceiver Station houses the radio transceivers that define a cell and handles the radio link protocols with the Mobile Station. In a large urban area, there will potentially be a large number of BTSs deployed. The requirements for a BTS are ruggedness, reliability, portability, and minimum cost. The Base Station Controller manages the radio resources for one or more BTSs. It handles radio channel setup, frequency hopping, and handovers, as described below. The BSC is the connection between the mobile and the Mobile service Switching Center (MSC). The BSC also translates the 13 kbps voice channel used over the radio link to the standard 64 kbps channel used by the Public Switched Telephone Network or ISDN. 5.3.3 Network Subsystem: The central component of the Network Subsystem is the Mobile services Switching Center (MSC). It acts like a normal switching node of the PSTN or ISDN, and in addition provides all the functionality needed to handle a mobile subscriber, such as registration, authentication, location updating, handovers, and call routing to a roaming subscriber. These services are provided in conjunction with several functional entities, which together form the Network Subsystem. The MSC provides the connection to the public fixed network (PSTN or ISDN), and signaling between functional entities uses the ITUT Signaling System Number 7 (SS7), used in ISDN and widely used in current public networks. The Home Location Register (HLR) and Visitor Location Register (VLR), together with the MSC, provide the call routing and (possibly international) roaming capabilities of GSM. The HLR contains all the administrative information of each subscriber registered in the corresponding GSM network, along with the current location of the mobile. The current location of the mobile is in the form of a Mobile Station Roaming Number (MSRN) which is a regular ISDN number used to route a call to the MSC where the mobile is currently located. There is logically one HLR per GSM network, although it may be implemented as a distributed database. The Visitor Location Register contains selected administrative information from the HLR, necessary for call control and provision of the subscribed services, for each mobile currently located in the geographical area controlled by the VLR. Although each functional entity can be implemented as an independent unit, most manufacturers of switching equipment implement one VLR together with one MSC, so that the geographical area controlled by the MSC corresponds to that controlled by the VLR, simplifying the signaling required. Note that the MSC contains no information about particular mobile stations - this information is stored in the location registers. The other two registers are used for authentication and security purposes. The Equipment Identity Register (EIR) is a database that contains a list of all valid mobile equipment on the network, where each mobile station is identified by its International Mobile Equipment Identity (IMEI). An IMEI is marked as invalid if it has been reported stolen or is not type approved. The Authentication Center is a protected database that stores a copy of the secret key stored in each subscriber's SIM card, which is used for authentication and ciphering of the radio channel.

The BTS and the BSC communicate across the specified Abis interface, enabling operations between components that are made by different suppliers. The radio components of a BSS may consist of four to seven or nine cells. A BSS may have one or more base stations. The BSS uses the Abis interface between the BTS and the BSC. A separate high-speed line (T1 or E1) is then connected from the BSS to the Mobile MSC.

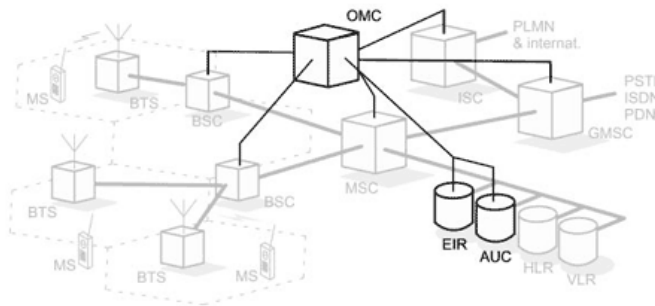
The BTS houses the radio transceivers that define a cell and handles the radio link protocols with the MS. In a large urban area, a large number of BTSs may be deployed. The BSC manages the radio resources for one or more BTSs. It handles radio channel setup, frequency hopping, and handovers. The BSC is the connection between the mobile and the MSC. The BSC also translates the 13 Kbps voice channel used over the radio link to the standard 64 Kbps channel used by the Public Switched Telephone Network (PSDN) or ISDN. It assigns and releases frequencies and time slots for the MS. The BSC also handles intercell handover. It controls the power transmission of the BSS and MS in its area. The function of the BSC is to allocate the necessary time slots between the BTS and the MSC. It is a switching device that handles the radio resources.

III. WRITE DOWN YOUR STUDIES AND FINDINGS

The Network switching system (NSS), the main part of which is the Mobile Switching Center (MSC), performs the switching of calls between the mobile and other fixed or mobile network users, as well as the management of mobile services such as authentication. The HLR is a database used for storage and management of subscriptions. The HLR is considered the most important database, as it stores permanent data about subscribers, including a subscriber's service profile, location information, and activity status. When an individual buys a subscription in the form of SIM then all the information about this subscription is registered in the HLR of that operator. The central component of the Network Subsystem is the MSC. The MSC performs the switching of calls between the mobile and other fixed or mobile network users, as well as the management of mobile services such as registration, authentication, location updating, handovers, and call routing to a roaming subscriber. It also performs such functions as toll ticketing, network interfacing, common channel signaling, and others. Every MSC is identified by a unique ID. The VLR is a database that contains temporary information about subscribers that is needed by the MSC in order to service visiting subscribers. The VLR is always integrated with the MSC. When a mobile station roams into a new MSC area, the VLR connected to that MSC will request data about the mobile station from the HLR. Later, if the mobile station makes a call, the VLR will have the information needed for call setup without having to interrogate the HLR each time. The Authentication Center is a protected database that stores a copy of the secret key stored in each subscriber's SIM card,



which is used for authentication and ciphering of the radio channel. The AUC protects network operators from different types of fraud found in today's cellular world. The Equipment Identity Register (EIR) is a database that contains a list of all valid mobile equipment on the network, where its International Mobile Equipment Identity (IMEI) identifies each MS. An IMEI is marked as invalid if it has been reported stolen or is not type approved. The Operation Support Subsystem (OSS): The operations and maintenance center (OMC) is connected to all equipment in the switching system and to the BSC. The implementation of OMC is called the operation and support system (OSS).



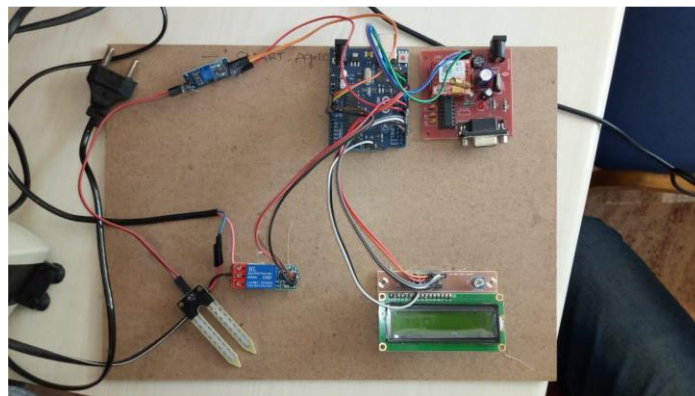
The OSS is the functional entity from which the network operator monitors and controls the system. The purpose of OSS is to offer the customer cost-effective support for centralized, regional and local operational and maintenance activities that are required for a GSM network. An important function of OSS is to provide a network overview and support the maintenance activities of different operation and maintenance organizations. Specifications for different Personal Communication Services (PCS) systems vary among the different PCS networks. The GSM specification is listed below with important characteristics. Modulation is a form of change process where we change the input information into a suitable format for the transmission medium. We also changed the information by demodulating the signal at the receiving end. The GSM uses Gaussian Minimum Shift Keying (GMSK) modulation method. Because radio spectrum is a limited resource shared by all users, a method must be devised to divide up the bandwidth among as many users as possible. GSM chose a combination of TDMA/FDMA as its method. The FDMA part involves the division by frequency of the total 25 MHz bandwidth into 124 carrier frequencies of 200 kHz bandwidth. One or more carrier frequencies are then assigned to each BS. Each of these carrier frequencies is then divided in time, using a TDMA scheme, into eight time slots. One time slot is used for transmission by the mobile and one for reception. They are separated in time so that the mobile unit does not receive and transmit at the same time. The total symbol rate for GSM at 1 bit per symbol in GMSK produces 270.833 K symbols/second. The gross transmission rate of the time slot is 22.8 Kbps. GSM is a digital system with an over-the-air bit rate of 270 kbps. Computers transfer data in two ways: parallel and serial. In parallel data transfers, often 8 or more lines are used to transfer data to a device that is only a few feet away. Although a lot of data can be transferred in a short amount of time by using many wires in parallel, the distance cannot be great. To transfer to a device located many meters away, the serial method is best suitable. The fact that serial communication uses a single data line instead of the 8-bit data line instead of the 8-bit data line of parallel communication not only makes it cheaper but also enables two computers located in two different cities to communicate over the telephone. Serial data communication uses two methods, asynchronous and synchronous. The synchronous method transfers a block of data at a time, while the asynchronous method transfers a single byte at a time. With synchronous communications, the two devices initially synchronize themselves to each other, and then continually send characters to stay in sync. Even when data is not really being sent, a constant flow of bits allows each device to know where the other is at any given time. That is, each character that is sent is either actual data or an idle character. Synchronous communications allows faster data transfer rates than asynchronous methods, because additional bits to mark the beginning and end of each data byte are not required. The serial ports on IBM-style PCs are asynchronous devices and therefore only support asynchronous serial communications. Asynchronous means "no synchronization", and thus does not require sending and receiving idle characters. However, the beginning and end of each byte of data must be identified by start and stop bits. The start bit indicates when the data byte is about to begin and the stop bit signals when it ends. The requirement to send these additional two bits causes asynchronous communication to be slightly slower than synchronous however it has the advantage that the processor does not have to deal with the additional idle characters. There are special IC chips made by many manufacturers for serial data communications. These chips are commonly referred to as UART (universal asynchronous receiver-transmitter) and USART (universal synchronous-asynchronous receiver-transmitter). The 8051 has a built-in UART.

An AC motor is an electric motor driven by an alternating current (AC). The AC motor commonly consists of two basic parts, an outside stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft

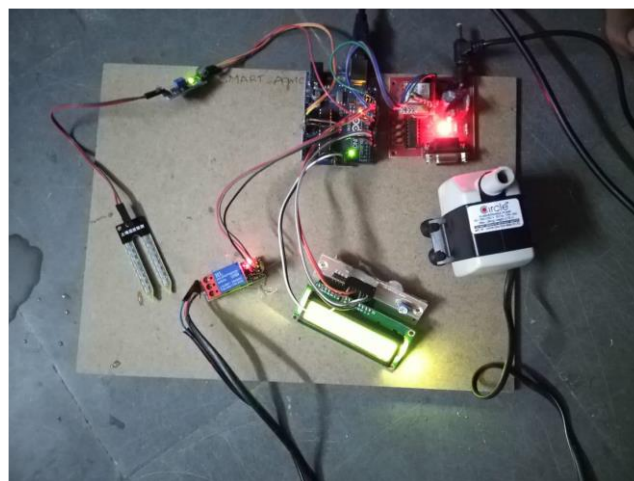
producing a second rotating magnetic field. The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings. Less common, AC linear motors operate on similar principles as rotating motors but have their stationary and moving parts arranged in a straight line configuration, producing linear motion instead of rotation. The two main types of AC motors are induction motors and synchronous motors. The induction motor (or asynchronous motor) always relies on a small difference in speed between the stator rotating magnetic field and the rotor shaft speed called slip to induce rotor current in the rotor AC winding. As a result, the induction motor cannot produce torque near synchronous speed where induction (or slip) is irrelevant or ceases to exist. In contrast, the synchronous motor does not rely on slip-induction for operation and uses either permanent magnets, salient poles (having projecting magnetic poles), or an independently excited rotor winding. The synchronous motor produces its rated torque at exactly synchronous speed. The brushless wound-rotor doubly fed synchronous motor system has an independently excited rotor winding that does not rely on the principles of slip-induction of current. The brushless wound-rotor doubly fed motor is a synchronous motor that can function exactly at the supply frequency or sub to super multiple of the supply frequency. Other types of motors include eddy current motors, and AC and DC mechanically commutated machines in which speed is dependent on voltage and winding connection.

IV. RESULTS AND DISCUSSION

Actual RPM for an induction motor will be less than this calculated synchronous speed by an amount known as slip, that increases with the torque produced. With no load, the speed will be very close to synchronous. When loaded, standard motors have between 2–3% slip, special motors may have up to 7% slip, and a class of motors known as torque motors are rated to operate at 100% slip (0 RPM/full stall).



Project kit



Project output



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International Journal For Advanced Research In Science & Technology

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ISSN: 2457-0362

V. CONCLUSION

In present days especially formers are facing major problems in watering there agriculture fields, its because they have no proper idea of when the power is available so that they can pump water. Even after then they need to wait until the field is properly watered which makes them stop doing others activities. Here is an idea that helps not only formers even for watering the gardens also, which sense soil moisture and switches the pumps automatically when the power is ON. Automatic irrigation system is very useful.

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