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Instinctive Escalation and Surveying System for Farming

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***Abstract*- Agriculture plays a crucial role in the Indian economy. It's not only a food and raw material but also provides employment opportunities. Instead of increasing the scale of agriculture a better way will be implementing smart is precision agriculture technique using IOT. This model can be very effective than the traditional method as risk of crop failure, less yield, excessive water supply or excessive use of fertilizers and pesticides ect. To monitor the environmental factors such as Temperature, humidity, soil moisture etc and help the formers in handling the crops automatically without any manual effort. The yield of any crop can be maximized with the help of precision agriculture by reducing the wastage. The data controlled by the sensor nodes deployed all over the field in sent to the cloud and there the data is analyzed and visualized for the ease of formers. With the help of visualized data formers can take precise and effective decision affecting their crops.**

***Keywords*- Precision agriculture, weather monitoring, smart agriculture, IOT.**

I.INTRODUCTION

Internet of Things (IOT) simply means the connection of various physical devices over the cloud. Idea of connecting physical devices over the internet to form a network can be game-changing in many fields. Agriculture is one such field that needs technology improvements sustain the growing food requirements.

1. AI:
IOT virtually makes anything "smart", meaning it advances every phase of life with the power of data collection, algorithms, and networks. For example a refrigerator can act as a smart refrigerator by keeping track of the cabinets inside and even ordering the products to the grocery shop that runs low.

2. Connectivity:
New technologies for networking are specifically IOT networking, means networks can exist on a much cheaper and smaller scale while still implementing practically. IOT creates these internal small networks between the system devices.

3. Sensors:
IOT works significantly on sensors. It is an act of defining instruments which transform from a standard passive network of devices to an active system flexible in real-world that is integrated.

4. Active Engagement:
Rise in the interaction technology is done with passive engagements, by integrating IOT concept a new model or pattern for active products, contents and service engagement can be introduced.

5. Small Devices:
In today's world devices have reduced in size, cheaper and more rigid over time. IOT exploits these small devices as it provides more scalability and are versatile in nature.

6. Application of IOT:
- Transportation domain
- Healthcare domain
- Smart environment (home, office, plant) domain
- Personal and social domain.

IOT refers to advancement in automation and analytical systems which exploits networking, sensing, tracking and artificial intelligence to deliver efficient system for product or services.

IOT systems provide greater transparency, control and performance and the applications from these are more unique, flexible and suitable in any environment. In simple terms, the concept can be explained as connecting any device over the internet.

An IOT system is based on devices that provide sensing, actuation, control, and monitoring activities. IOT devices can exchange data with other connected devices and application, or collect data from other devices and process the data either locally or send the data to centralized servers or cloud based applications back-ends for processing the data, or perform some tasks locally and other tasks within IOT infrastructure based on temporal and space constraints.

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II. RELATED WORK

Monitoring of soil health, the environment, and managing irrigation is a major challenge faced in farming. Paper [1] discusses a system to gain control over such issues with the help of IOT. It connects both physical sensing devices and irrigation control mechanisms to the cloud.

This helps to analyze the architecture. Its final results tell us that data in real-time can be mitigated with low latency. Migration has shown a major hindrance to agriculture.

The author in the paper [2,14] makes use of temperature, monitoring, security, moisture and GPS sensing for the betterment of agriculture. These features can be used by users over remote devices or the internet.

In the paper [3] a design for smart IOT communication is presented which requires joining IOT, Wireless Sensor Network and mapping aerial. The paper calculates the bandwidth when different commands and data are sent by the system. The designed system is controlled remotely using a mobile phone. The authors of the paper [4,11] give us a proposal of a prototype for accurate farming using a wireless sensor network with an IOT cloud. They describe an alert system for controlling the water stress of plants. In addition, this application is also used to estimate the quantities of water required. Paper [5,22] provides us with a cloud- based IOT architecture which can be used in various precision their implementation.

Having a good efficiency, this architecture can be used for implementing different precision agriculture systems. Greenhouse surrounding using wireless sensor network or WMSN in the paper [6] shows that automatic irrigation is more efficient than the scheduled irrigation. Automatic irrigation is successful in efficiently optimizing the usage of water and fertilizers. In addition to this, it also maintains the wetness of the level of the crop at an equal level as advised by an agronomist.

The authors in the paper [7] takes use of CC3200 single chip to monitor temperature and humidity in the agricultural field. It uses a camera to click pictures and send it to farmers mobile through multimedia messaging service using Wi-Fi. Its application helps in advancing the harvesting of crops and worldwide production.

Paper [8,23] described the use of various technologies like cloud computing, big data analytics, internet of things, sensors and mobile computing for creating a model for smart agriculture.

The model has been designed to benefit the farmers by increasing agricultural production by having a reduction in the cost of fertilizer requirement and cost of its Argo products. This paper [8] also helps in estimating production per crop and total fertilizer requirement.

III. PROPOSED WORK

- Smart farming is needed using IOT technologies which helps farmers to enhance crop productivity as it is more accurate process for crops.
- If farmers adopt precision agricultural techniques maximize their yield.
- Hence reduce the excessive or less water supply.
- Soil Moisture sensor is used for measure land dry status for irrigation purpose.
- Temperature sensor sensed atmosphere temperature value. And humidity sensor sensed humidity level.
- Water level sensor sensed water level.
- Display unit displayed corresponding sensor value.
- All sensor data is stored in IOT server. It is easy to understand the pattern using the Dashboard Controller interface is implemented using the MQTT protocol.
- IOT BLYNK mobile app used for monitoring and controlling purpose (pumping motor, relay section, solenoid valve).

IV. DESIGN AND IMPLEMENTATION

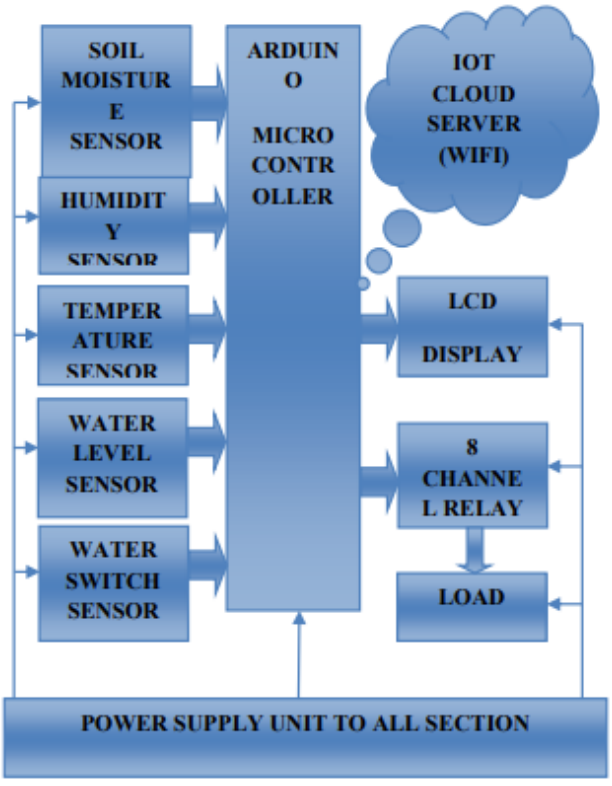

Fig 1. Block Diagram.

1. Arduino Micro Controller:

The Arduino microcontroller is an easy to use yet powerful single board computer that has gained considerable traction in the hobby and professional market. The Arduino is open source, which means hardware is reasonably priced and development software

is free. This guide is for students in ME 2011, or students anywhere who are confronting the Arduino for the first time. for advanced Arduino users, prowl the web; there are lots of resources. The Arduino project was started in Italy to develop low cost hardware for interaction design. An overview is on the Wikipedia entry for Arduino. The Arduino home page is The Arduino hardware comes in several flavors. The Duemilanove board features an Atmel ATmega328 microcontroller operating at 5 V with 2 Kb of RAM, 32 Kb of flash memory for storing programs and 1 Kb of EEPROM for storing parameters.

The clock speed is 16 MHz, which translates to about executing about 300,000 lines of C source code per second. The board has 14 digital I/O pins and 6 analog input pins. There is a USB connector for talking to the host computer and a DC power jack for connecting an external 6-20 V power source, for example a 9 V battery, when running a program while not connected to the host computer. Headers are provided for interfacing to the I/O pins using 22 g solid wire or header connectors.

For additional information on the hardware, see The Arduino programming language is a simplified version of C/C++. If you know C, programming the Arduino will be familiar. If you do not know C, no need to worry as only a few commands are needed to perform useful functions. An important feature of the Arduino is that you can create a control program on the host PC, download it to the Arduino and it will run automatically.

2. Pin Diagram:

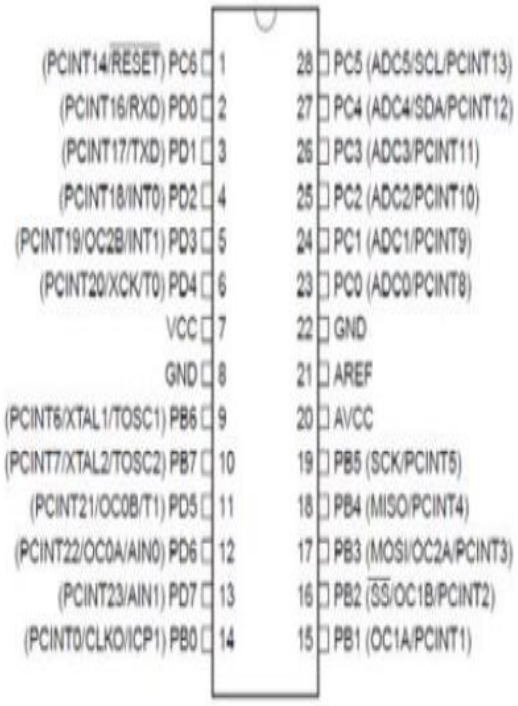

Fig 2. Pin Diagram.

3. LCD Display:

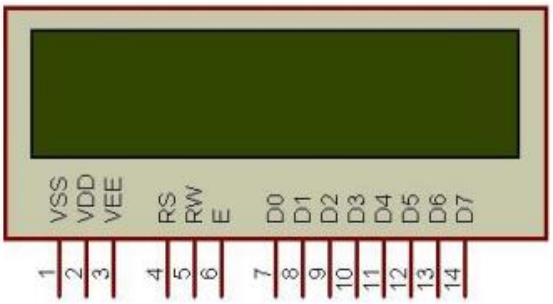

Fig 3. LCD Display.

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 command register stores the command instructions given to the LCD, The data register stores the data to be displayed on the LCD The data is the ASCII value of the character to be displayed on the LCD. Liquid crystal displays are used for display of numeric and alphanumeric character in dot matrix and segmental displays.

The two liquid crystal materials which are commonly used in display technology are nematic and cholesteric whose schematic arrangement of molecules is shown in fig. The most popular liquid crystal structure is the Nematic Liquid Crystal (NLC). In this all the molecules align themselves approximately parallel to a unique axis (director), while retaining the complete translational freedom.

4. Power Supply Unit:

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

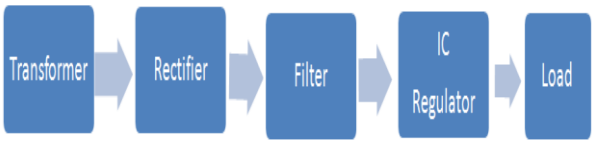

Fig 4. Block diagram (Power supply).

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5. IC Voltage Regulators:

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power.

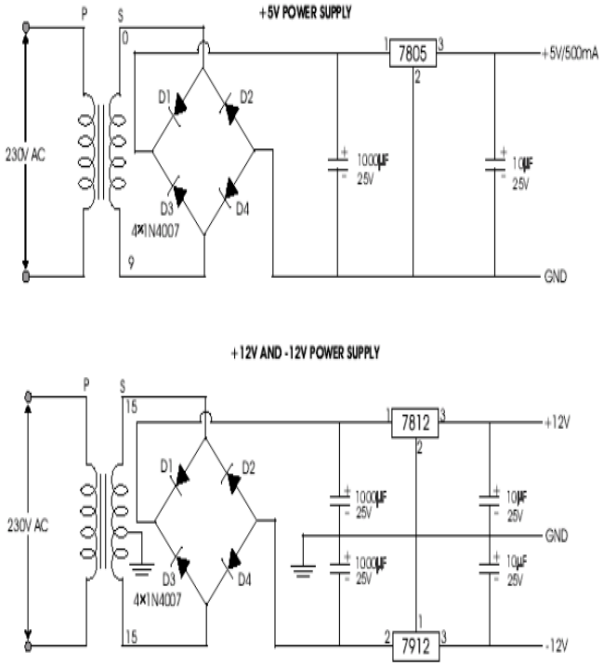

Fig 5. IC Voltage Regulator Circuit Diagram.

6. Humidity Sensor:

Humidity is the measure of the amount of water vapor present in the air. Humidity is calculated as Relative humidity and Absolute humidity. For industrial and medical environments relative humidity becomes an important factor. A rise in the values of humidity, beyond threshold levels, can lead to malfunctioning of control systems, errors in weather prediction systems. So, as a security and safety factor, measurement of humidity values is very important.

Humidity sensors are used to measure the humidity values. Relative sensors also measure air temperature. But this type of sensor is not useful for temperatures above 100 degree Celsius. Humidity Sensors are the low cost-sensitive electronic devices used to measure the humidity of the air. These are also known as Hygrometers. Humidity can be measured as Relative humidity, Absolute humidity, and Specific humidity. Based on the type of humidity measured by sensor, these are classified as Relative Humidity sensor and Absolute Humidity sensor.

Based on the parameters used to measure humidity, these sensors are also classified as Capacitive Humidity Sensor, Resistive Humidity Sensor, and Thermal Conductivity Humidity Sensor. Some of the parameters to consider while choosing these sensors are the Accuracy, Linearity, Reliability, Repeatability and Response time.

Fig 6. Humidity Sensor.

7. NODEMCU ESP8266:

Fig 7. NODEMCU ESP8266.

Node MCU is an open-source Lua based firmware and development board specially targeted for IOT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

8. Soil Moisture Sensor:

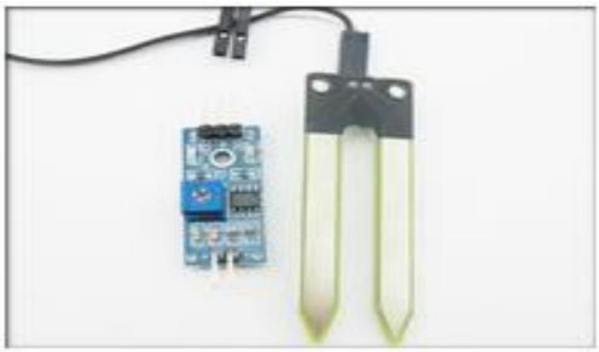

Fig 8. Soil Moisture Sensor.

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Soil moisture sensors measure the water content in soil. A soil moisture probe is made up of multiple soil moisture sensors. This Soil Moisture Sensor can be used to detect the moisture of soil or judge if there is water around the sensor. Let the plants in your garden reach out for human help. Insert this module into the soil and then adjust the on-board potentiometer to adjust the sensitivity. The sensor would output logic HIGH/LOW when the moisture is higher/lower than the threshold set by the potentiometer.

9. Water Level Sensor:

The Water Level Sensor module consists of two boards, namely Rain Board and Control Board. The Water Level Sensor consists of two copper tracks, designed in such a way that under the dry conditions they provide high resistance to the supply voltage, and this output voltage of this module will be 5V. This module's resistance gradually decreases with respect to an increase in the wetness on the board. As the resistance decreases, its output voltage also decreases with respect to the wetness on the module. The Water Level Sensor module consists of two pins used to connect to the control board as shown below.

Fig 9. Water Level Sensor.

Control Board module controls the sensitivity and converts the analog output to digital output. If the analog value is below the threshold value of the control board, the output is digital low, and if the analog value is higher than the threshold value, the output is digital high. For this comparison and conversion, an LM393 OP-Amp Comparator is used.

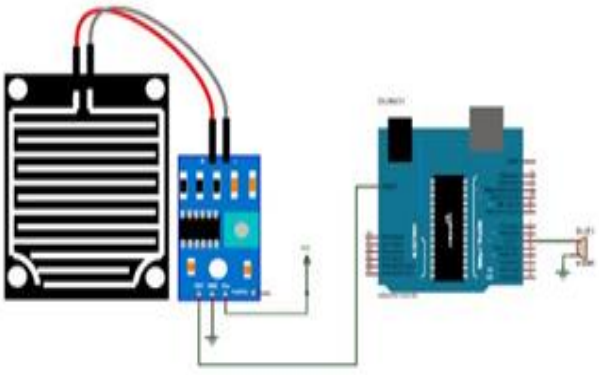

Fig 10. Circuit.

An Op-Amp comparator is an interesting circuit that can be used to compare two different voltage values, we have already used in this circuit in many projects like Smart Electronic Candle, Laser Security Alarm, Line Follower Robot and much more.

The Water Level Sensor module which is shown below consists of 4 pins to connect the Arduino namely VCC, GND, D0, A0 and two more pins to connect the rain board module. In summary, the rain board module detects the Water Level Sensor, and the control board module is used to control the sensitivity and compare and convert the analog values to digital values.

10. Relay Board:

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

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

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

Fig 11. Relay.

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available.

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11. Relay Driver Circuit:

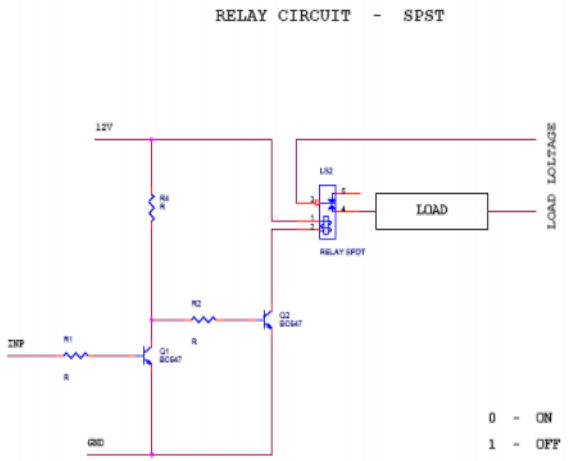

Fig 12. Relay Driver Circuit.

Now the problem with the internal reset circuit is, it is highly dependent on power supply, to meet this critical power supply conditions is not hard but are difficult to achive when you are making a simple application. So usually the second method i.e. Initialization by instruction is used and is recommended most of the time.

12. Overall Circuit Diagram:

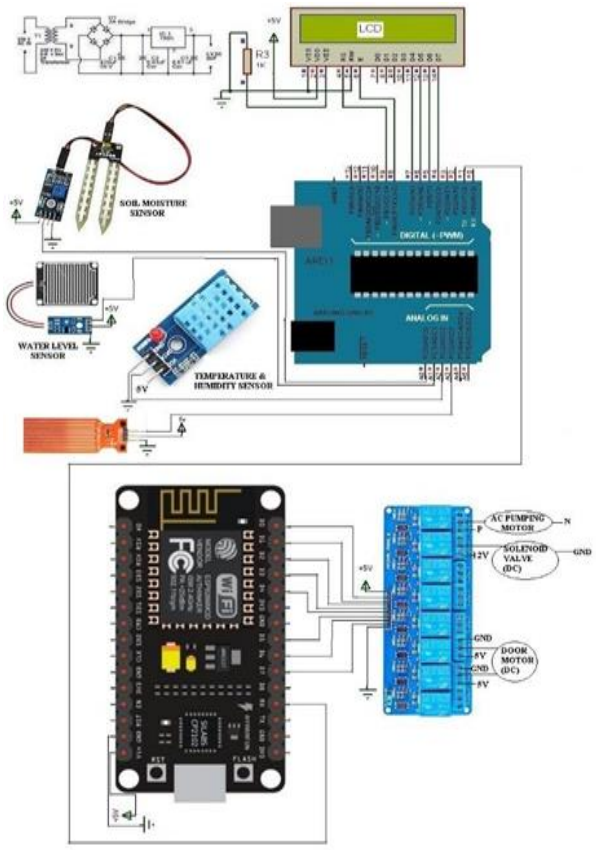

Fig 13. Overall Circuit Diagram.

13. Monitor And Control Section:

Fig 14. Monitor and Control Section.

14. Arduino C Compiler:

Arduino development tools for the Arduino BT Microcontroller Architecture support every level of software developer from the professional applications engineer to the student just learning about embedded software development. The industry-standard Arduino C Compilers, Macro Assemblers, Debuggers, Real-time Kernels, Single- board Computers, and Emulators support all ATMEGA derivatives and help you get your projects completed on schedule.

The Arduino ATMEGA Development Tools are designed to solve the complex problems facing embedded software developers. When starting a new project, simply select the microcontroller you use from the Device Database and the Arduino IDE sets all compilers, assembler, linker, and memory options for you. Numerous example programs are included to help you get started with the most popular embedded ATMEGA devices. The Arduino C Compiler Debugger accurately simulates on-chip peripherals (I^2C, CAN, UART, SPI, Interrupts, I/O Ports, A/D Converter, D/A Converter, and PWM Modules) of your ATMEGA device. Simulation helps you understand hardware configurations and avoids time wasted on setup problems. Additionally, with simulation, you can write and test applications before target hardware is available. When you are ready to begin testing your software application with target hardware, use the MON51, MON390, MONADI, or FlashMON51 Target Monitors, the ISD51 In-System Debugger, or the ULINK USB- JTAG Adapter to download and test program code on your target system.

It's been suggested that there are now as many embedded systems in everyday use as there are people on planet Earth. Domestic appliances from washing machines to TVs, video recorders and mobile phones, now include at least one embedded processor. They are also vital components in a huge variety of automotive, medical, aerospace and military systems. As a result, there is strong

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demand for programmers with 'embedded' skills, and many desktop developers are moving into this area .Embedded C is designed for programmers with desktop experience in C, C++ or Java who want to learn the skills required for the unique challenges of embedded systems.

15. Internet of Things (IOT):

The Internet of Things is an emerging topic of technical, social, and economic significance. Consumer products, durable goods, cars and trucks, industrial and utility components, sensors, and other everyday objects are being combined with Internet connectivity and powerful data analytic capabilities that promise to transform the way we work, live, and play. Projections for the impact of IOT on the Internet and economy are impressive, with some anticipating as many as 100 billion connected IOT devices and a global economic impact of more than $11 trillion by 2025. At the same time, however, the Internet of Things raises significant challenges that could stand in the way of realizing its potential benefits.

Attention-grabbing headlines about the hacking of Internet-connected devices, surveillance concerns, and privacy fears already have captured public attention. Technical challenges remain and new policy, legal and development challenges are emerging. The term Internet of Things generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention. There is, however, no single, universal definition.

16. Simulator:

The Arduino hardware simulator for the popular Arduino BT Microcontroller is on the CD-ROM so that readers can try out examples from the book and create new ones without requiring additional hardware. All code is written in C, so no assembly language is required. Industry-standard C compiler from Keil software is included on the CD- ROM, along with copies of code examples from the book to get you up and running very quickly. Key techniques required in all embedded systems are covered in detail, including the control of port pins and the reading of switches. A complete embedded operating system is presented, with full source code on the CD-ROM. Achieve outstanding application performance on Intel processors using ATMEGA C Compiler for Windows, including support for the latest Intel multi-core processors. For out-of-the-box productivity, Intel C Compiler plugs into the Microsoft Visual Studio development environment for IA-32 and features a preview plug-in to the Microsoft Visual Studio.

NET environment. This chapter provides information about the C compiler, including operating environments, standards conformance, organization of the compiler, and C- related programming tools. There are a number of tools available to aid in developing, maintaining, and improving your C programs. The two most closely tied to C, c scope and lint, are described in this book. In addition, a man page exists for each of these tools. Refer to the preface of this book for a list of all the associated man pages.

V. EXPERIMENTAL RESULT

1. BLYNK Mobile Application:

Fig 15. BLYNK Mobile Application.

2. Output:

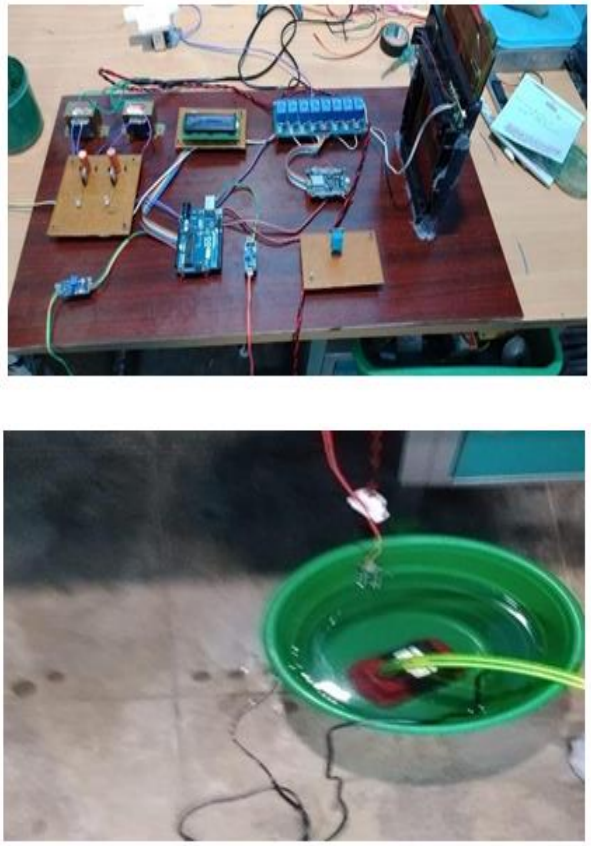

Fig 16. Output.

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VI. CONCLUSION

Agriculture is one of the most important things in any country and its improvement is very vital. Traditional farming methods are not very efficient and farmers usually face a lot of problems that cannot be resolved by traditional methods. Hence technological improvement in this field is necessary. Smart agriculture or precision agriculture using IoT is a very efficient and effective method compared to the traditional ones.

In this paper, we demonstrated an IoT based model for smart agriculture that is capable of solving many problems that farmers face. Our model has three modules- crop selection module, crop monitoring system module and crop maturity level module. All three modules are properly described in the paper with the architecture of each module and our result shows that the proposed work is very useful in making accurate decisions based on the visualized data viewable at the user end through a Web app.

All the data collected by different sensors is analyzed and visualized in the form of graphs. Based on the values farmers can take decisions like if the soil moisture percentage is less, crops can be irrigated. The overall cost of the system is very less and the sensors used are easily available. Hence this system can be used by every farmer to increase their crop production.

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