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# IOT-BASED SOLAR SMART IRRIGATION WITH PROTECTION FROM WILD ANIMALS

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**Abstract:** *With the incremental growth of the market population, limited arable land, or the depletion of nonrenewable resources, the need to improve crop yields has become critical. Local resources also including land and arable land, etc and declining yield patterns through key staple crops, have exacerbated the problem. Another concern for the farmer is the effective model of agricultural labour. Furthermore, in the majority of countries, agricultural work has decreased. Because of the shrinking agricultural workforce, the use of internet connection solutions in farming practises has accelerated in order to reduce the requirement for physical labour. The Ict in agriculture includes sophisticated equipment, internet network, technology, and IT services. Including a BI Intelligence report, the number of IoT nodes deployed in the agricultural sector might reach 1.8 billion by 2020, growing at a 20% annual pace. Simultaneously, the global smart agriculture industry is expected to treble in size by 2025, surpassing $15.3 billion. Farming, which also is dependent on IoT technology, enables farmers to reduce waste and boost productivity in a number of different ways, including the quantity of fertiliser used, the volume of trips made by heavy vehicles, and the efficient use of resources such as water and electricity. Sensors are used to monitor the agricultural field and manage the watering system in IoT smart farming systems.*

*Farm crops are frequently attacked by local animals such as buffaloes, cows, goats, and birds. Farmers suffer significant losses as a result of this. Farmers cannot block entire fields or sit on them 24 hours a day to guard them. As a result, we suggest an animal-proof crop protection system. This is a microcontroller-based system that uses microcontrollers from the ARM7 family. A motion sensor is used in this system to detect endangered beasts approaching the field. In this example, the sensor instructs the microcontroller to operate. The microcontroller now plays an alert to entice the mammals away from the pack, as well as sending data to that same farmer so that he is aware of the problem and can respond quickly if the animals do not flee. This ensures that crops are completely safe from animals, preventing the farmer from losing money.*

**Keywords:** *Farming, GSM, IOT, precision, capital resources.*

## I. INTRODUCTION

Agriculture plays an important role in economy and development. The agriculture is in the transition from traditional agriculture to modern agriculture currently. For continuously increasing demand of food necessities, rapid improvement in production of food technology is important. In the paper our main focus is to maintain, control or monitor the agricultural trends or system making it easier for the user, to get data at regular interval about the field. In many areas one person is not enough to monitoring the field status and control things. To improve we have to focus on the agriculture monitoring system and to collect more area information. In agriculture, there are two important factors, first to get information about fertility of soil and second is to measure moisture content in soil. Nowadays for irrigation, different techniques are available which is used to reduce the dependency on rain. And mostly this technique is driven by electrical power and on/off scheduling controlled system. Here we have used sensors to create an agricultural monitoring system like soil moisture sensor, temperature sensor. Soil moisture sensor is basically used to measure the soil moisture level and the temperature sensor is used to keep the track of temperature.GSM sim 900 is being used for sending the data to the user.

Smart environment includes smart energy including renewable, ICT enabled energy grids, metering, pollution control and monitoring, renovation of buildings and amenities, green buildings, green urban planning, as well as resource use efficiency, re-use and resource substitution which serves the above goals. Urban services such as street lighting, waste management drainage systems, and water resource systems that are monitored to evaluate the system, reduce pollution and improve water quality are also good examples. Here the sensors are being used as a medium between the agricultural fields. This feature allows the user to control and monitor the crops and prevents it from being rotten. Main feature of this technology is to reduce manual work and monitor the agricultural system by making it fully computerized.

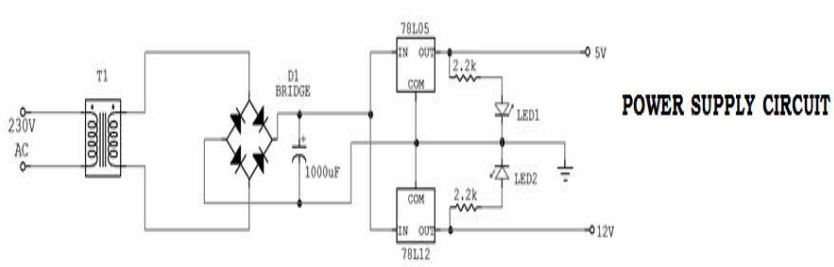
***Fig 1. Automatic water control unit***

## II. LITERATURE SURVEY

An IOT Based Crop-field monitoring an irrigation automation system describes how to monitor a crop field. A system is developed by using sensors and according to the decision from a server based on sensed data, the irrigation system is automated. Through wireless transmission the sensed data is forwarded to web server database. If the irrigation is automated then the moisture and temperature fields are decreased below the potential range. The user can monitor and control the system remotely with the help of application which provides a web interface to user [1]. By smart Agriculture monitoring system and one of the oldest ways in agriculture is the manual method of checking the parameters. In this method farmers by themselves verify all the parameter and calculate the reading [2]. The system focuses on developing devices and tool to manage, display and alert the users using the advantages of a wireless sensor network system. It aims at making agriculture smart using automation and IoT technologies [3]. The cloud computing devices are used at the end of the system that can create a whole computing system from sensors to tools that observe data from agriculture field. It proposes a novel methodology for smart farming by including a smart sensing system and smart irrigator system through wireless communication technology [4]. This system is cheap at cost for installation. Here one can access and also control the agriculture system in laptop, cell phone or a computer [5]. An IOT Based Crop-field monitoring an irrigation automation system describes how to monitor a crop field. A system is developed by using sensors and according to the decision from a server based on sensed data, the irrigation system is automated. Through wireless transmission the sensed data is forwarded to web server database. If the irrigation is automated then the moisture and temperature fields are decreased below the potential range. The user can monitor and control the system remotely with the help of application which provides a web interface to user [1]. By smart Agriculture monitoring system and one of the oldest ways in agriculture is the manual method of checking the parameters. In this method farmers by themselves verify all the parameter and calculate the reading [2]. The system focuses on developing devices and tool to manage, display and alert the users using the advantages of a wireless sensor network system. It aims at making agriculture smart using automation and IoT technologies [3]. The cloud computing devices are used at the end of the system that can create a whole computing system from sensors to tools that observe data from agriculture field. It proposes a novel methodology for smart farming by including a smart sensing system and smart irrigator system through wireless communication technology [4]. This system is cheap at cost for installation. Here one can access and also control the agriculture system in laptop, cell phone or a computer [5].

## III. RELATED WORK

The hardware is interfaced with all the sensors in the board. The hardware components include the microcontroller, a water pump, relay,12 V battery, Wi-fi sensor and the soil moisture sensor is interfaced and power supply has provided. The system has been tested for watering a plant in a garden. In the field section, sensors are deployed in the field like soil moisture. The data collected from these sensors are sent to the Database via the android application. In control section, the system is turned on using the application, this is done using the on or off buttons in the application. Also, this system is turned on automatically when the moisture of the soil is low, the pump is turned on and depending on the moisture content. The application has a future feature of taking the time from the user and irrigates the field when the time comes. In manual mode, there is a manual switch in the field to make sure that if the system fails, one can turn off the water supply manually.



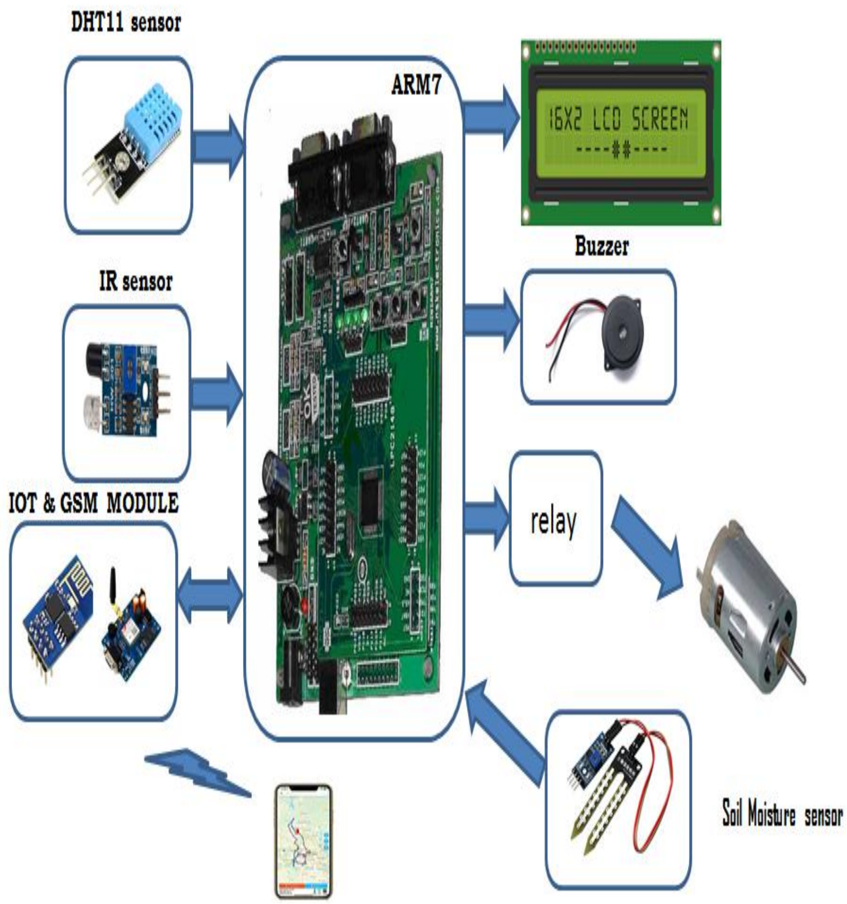




*Fig 2. Proposed Block Diagram*

***A. CORTEX M3***

The Cortex-M3 processor is specifically developed to enable partners to develop high performance low-cost platforms for a broad range of devices including microcontrollers, automotive body systems, industrial control systems and wireless networking and sensors. Arm Design Start provides the fastest, simplest, no-risk route to custom silicon success.

- ✓ Design the most optimal System-On-Chip with a processor that has the perfect balance between area, performance and power with comprehensive system interfaces and integrated debug and trace components.
- ✓ Develop solutions for a large variety of markets with a full-featured Armv7-M instruction set that has been proven across a broad set of embedded applications.

- ✓ Capture a worldwide experienced developer base to accelerate adoption of new Cortex-M3 powered products and leverage the available extensive knowledge base to reduce support costs.
- ✓ Achieve exceptional 32-bit performance with low dynamic power, delivering leading system energy efficiency due to integrated software controlled sleep modes, extensive clock gating and optional state retention.

*Powerful debug and non-intrusive real-time trace*

Comprehensive debug and trace features dramatically improve developer productivity. It is extremely efficient to develop embedded software with proper debug.

*Memory Protection Unit (MPU)*

Software reliability improves when each module is allowed access only to specific areas of Memory required for it to operate. This protection prevents unexpected access that may overwrite critical data.

*Integrated nested vectored interrupt controller (NVIC)*

There is no need for a standalone external interrupt controller. Interrupt handling is taken care of by the NVIC removing the complexity of managing interrupts manually via the processor.

*Thumb-2 code density*

On average, the mix between 16bit and 32bit instructions yields a better code density when compared to 8bit and 16bit architectures. This has significant advantages in terms of reduced memory requirements and maximizing the usage of precious on-chip Flash memory.

***B. IR SENSOR***

A device like a systems are installed infrared LED has to be treated carefully. IR LEDs are created using low-power broad heterostructures with nothing but a bandgap of 0.25 to 0.4 eV. As a consequence, the bias required to start current flow is much lower than for well-known noticeable or NIR LEDs. The usual upward bias for mid-IR LEDs is V0.1–1 V.!

***Fig3. IR Sensor***

***C. SPDT***

A relay is an electrically operated switch used to isolate one electrical circuit from another. In its simplest form, a relay consists of a coil used as an electromagnet to open and close switches contacts.

Since the two circuits are isolated from one another, a lower voltage circuit can be used to trip a relay, which will control a separate circuit that requires a higher voltage or amperage. Relays can be found in early telephone exchange equipment, in industrial control circuits, in car audio systems, in automobiles, on water pumps, in high-power audio amplifiers and as protection devices.

The switch contacts on a relay can be "normally open" (NO) or "normally closed" (NC)-- that is, when the coil is at rest and not energized (no current flowing through it), the switch contacts are given the designation of being NO or NC. In an open circuit, no current flows, such as a wall light switch in your home in a position that the light is off. In a closed circuit, metal switch contacts touch each other to complete a circuit, and current flows, similar to turning a light switch to the "on" position. In the accompanying schematic diagram, points A and B connect to the coil. Points C and D connect to the switch.

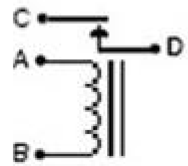



***Fig 4. Relay connection***

***D. SOIL SENSOR***

Other soil principles such as absorption coefficient, electrical resistivity, otherwise radioactive interaction, et moisture content displacement are used to determine the physical amount indirectly. The link between the calculated property & soil moisture needs be tweaked, and it may change based on environmental factors including climate, soil type, and electrical conductivity. The reflection microwave emission is based on soil moisture and is often used in agriculture and hydrology for object tracking.

These sensors are often used to detect volumetric water content, while another set of sensors creates an unique moisture characteristic known as water potential within soils.

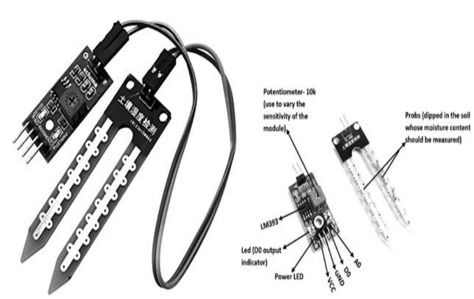



***Fig5. . Soil Sensor***

***E. DHT11***

**DHT11 Specifications**

3.5V to 5.5V operating voltage Systems is to ensure: 0.3mA (sensing) 60uA (standby)
Serial data is the output.

Temperatures range from 0°C to 50°C, with humidity levels ranging from 20% to 90%.

Temperature and humidity are both 16-bit resolution.

Accuracy: 1 degree Celsius and 1 percent

**DHT11 Sensor and Module: What's the Difference?**

The DHT11 sensor may be purchased alone or as part of both a module. In both cases, the sensor's efficacy is same. The device will be housed in something like a 4-pin box and with only pin 1 used, while the device will be housed in a three-pin box as shown above.

The only difference between the sensor and indeed the component is whether the module contains a filtering resistor or a pull-up impedance, while the sensor does not.

**Where to use DHT11 Sensors**

An very popular relative humidity sensor is the DHT11. The sensor has an 8-bit microcontroller for serial data output of temperature and moisture readings and a separate NTC for temperature measurement. Since the sensor has been thoroughly calibrated, connecting it to additional microcontrollers is straightforward.

The sensor can measure temperature between 0°C plus 50°C and dryness between 20% and 90% with an efficiency of 1°C and 1%, respectively. Therefore, if you wish to monitor within that range, this sensor can be a good option..

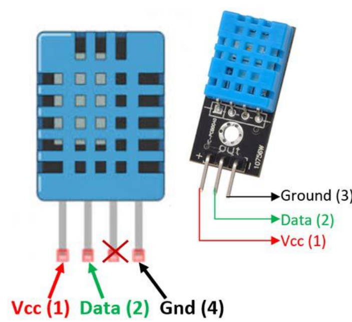



***Fig6. . DHT11 Sensor***

## IV. INTERNET OF THINGS

The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

***Fig 5 . Internet of things Interfacing***

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces; it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

There is an almost limitless fountain of information available for the ESP8266, all of which has been provided by amazing community support. In the *Documents* section below you will find many resources to aid you in using the ESP8266, even instructions on how to transforming this module into an IoT (Internet of Things) solution.


***Fig6. ESP8266 IOT module***

There seems to be three ways of using this module, in order of increasing complexity:
1. Sending it AT commands from a computer via an USB to serial adapter. This is mostly useful for testing and setup.
2. Interfacing with cortex M3 or any other micro controller and using this board as a peripheral.
3. Programming the module directly and use its GPIO pins to talk to your sensors, eliminating the need for a second controller.

## IV. RESULT ANALYSIS

The Internet of Things provides access to a broad range of embedded devices and web services. Thing Speak is an open data platform and API for the internet of Things that enables you to collect, store, analyze, visualize, and act on data from sensors or actuators, such as Cortex M3, Beagle Bone Black, and other hardware. For example, with Thing Speak you can create sensor-logging applications, location tracking applications, and a social network of things with status updates, so that you could have your home thermostat control itself based on your current location. The primary element of Thing Speak activity is the channel, which contains data fields, location fields, and a status field. After you create a Thing Speak channel, you can write data to the channel, process and view the data with MATLAB® code, and react to the data with tweets and other alerts. The typical Thing Speak workflow lets you:

1. Create a Channel and collect data
2. Analyze and visualize the data
3. Act on the data using any of several Apps.

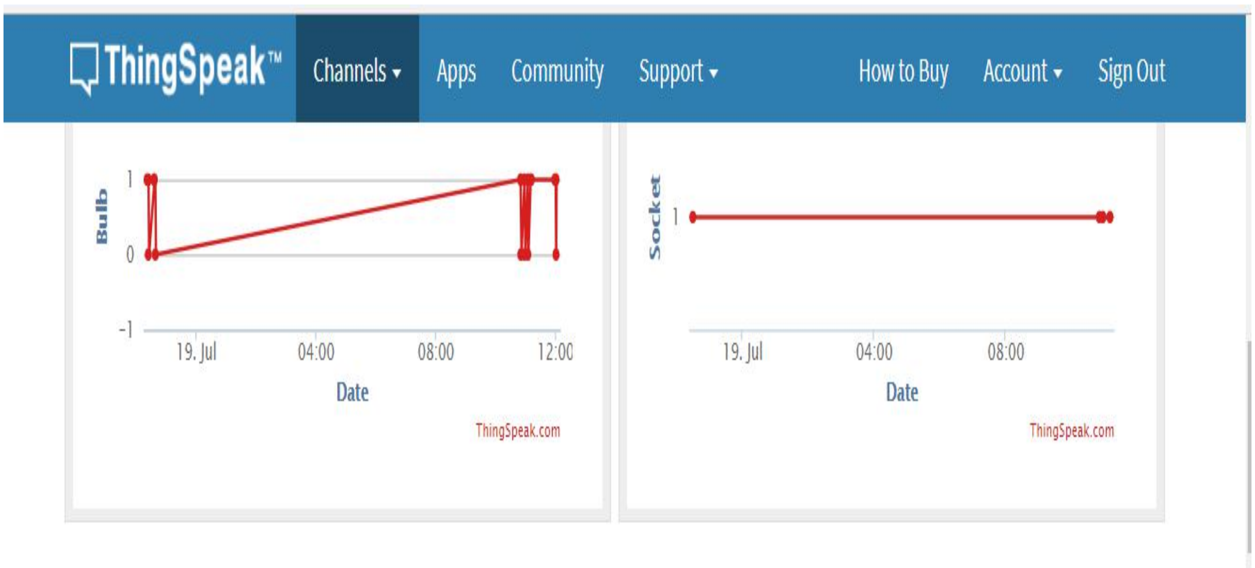



***Fig 7. Graphical representation of output***

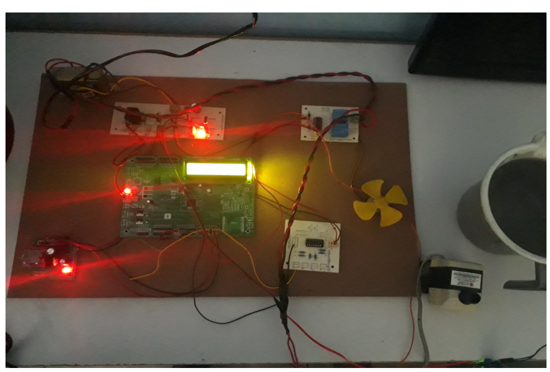


***Fig 8. Hardware kit output***

## VI. CONCLUSION

This project helps us to know the significance of using wireless device net in rural areas. This project sheds the light on the cultivation in India and it shows how the automation of cultivation using wireless device network helps us to resolve a lot of Indian agrarian trouble and recuperate the harvest. An instance of the greatest significant harvests is designated, which is the vegetable harvest, to training the practice of wireless device system for exactness undeveloped in India. This project can be implemented with a cheaper cost and can yield a better result.

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