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Er. Sheikh Ovais Reyaz
Guru Nanak Institutions, Mullana, Ambala, Haryana, India

Corresponding Author:
Er. Sheikh Ovais Reyaz
Guru Nanak Institutions, Mullana, Ambala, Haryana, India

Wireless autonomous irrigation system

Er. Sheikh Ovais Reyaz

Abstract
Wireless autonomous irrigation system is a system that will work either autonomously or through wireless control system, using the multiple sensors and the information from the weather department to irrigate a crop field at the required time and season without human intervention in order to provide maximum yield to farmers. This term consists of two words. The first word "autonomy" means self-management, i.e., no human intervention. The second part of the sentence "system" refers to a set of complex parts that together form a complex, intelligent system. Combining these two words, you get a complex of independent operating systems that can learn, adapt, and scan your environment. In the near future, these autonomous devices will be deployed worldwide and will perform important tasks in a variety of areas, including following sectors AS will also be important and complex in terms of communication. One of the most important features is connectivity which stands for pairing autonomous systems between each other as well as with nonAS objects and systems. What does connectivity bring to the world?

Keywords: Wireless autonomous irrigation system

Introduction

The most important thing about this is safety and the second thing is user convenience. For example, in the automotive sector, there is a strict distinction between safe and unsafe applications that can be implemented using Car to Everything (V2X) communication to provide information to each other about obstacles, pedestrians, next maneuvers, and more.

While adding the wireless with these systems it makes them mobile and easy to use from any where around the world. There is a lot scope to wireless autonomous systems in every possible field and is a revolutionary step towards the modern world.

Today everyone among us is having a smartphone with 4G internet connectivity and 5G also arriving so I believe it is the best time to introduce wireless autonomous systems to the places where it is almost impossible to work or reach and by introducing these systems, we can help them solve many problems.

In the Automotive industry we've seen Tesla bringing a revolution to the industry. Built on a deep neural network, Autopilot uses cameras and ultrasonic sensors to determine and sense the environment round the car. This robust sensor and camera suite provides drivers with an awareness of their surroundings that a driver alone wouldn't otherwise have. A powerful on board computer processes these inputs in an exceedingly matter of milliseconds to assist make your driving safer and fewer stressful. Involving electric rechargeable batteries had also proved to be important for the environment yet as for the shoppers in addition. In India we've got seen an amazing improvement within the autonomous system of industry. Recently, Mahindra India has introduced ADAS. Advanced Driver Assistance System (ADAS) is an extremely powerful electronic system in a vehicle that uses advanced technologies to assist the engine. They will include many active safety features and sometimes the terms "ADAS" and "active safety" are used interchangeably. ADAS uses in-vehicle sensors such as radar and cameras to perceive the globe around it, then provides information for its dynamics or takes automated action based on what it receives. ADAS features that provide information will most ordinarily include "warning" within the name.

As an example, if the vehicle detects an object like another vehicle or a cyclist during a location where the motive force might not be ready to see them, features like blind spot warning or rear backup warning will alert the motive force. Likewise, if the system determines that the vehicle is drifting out of its lane, it could activate lane departure warning

to alert the driving force. When these detections are plus a technology that takes action beyond a straightforward warning, ADAS becomes a full of life safety system – meaning the vehicle will "actively" control braking or steering. These features most ordinarily include "assistance" within the name. Other companies also are trying to incorporate these systems also to compete with the rival company as people are seen to be liking this technology. The rapid development of autonomous systems and knowledge and communication technology (ICT) is creating new opportunities within the field of maritime activities. Existing autonomous systems include autonomous underwater vehicles, unmanned underwater vehicles (sometimes called autonomous underwater vehicles, and unmanned aerial vehicles. Taking advantage of the features, it's becoming more powerful., Mooring and propulsion systems, and therefore the recently emerging autonomous underwater vehicle. Their importance in providing new services within the maritime environment is undeniable, and therefore the opportunities for coordinated and interconnected operations are clear. However, the continued widespread integration of assorted technologies within the marine environment still faces many challenges. Since operations is performed remotely, it's necessary to anticipate reliance on third-party infrastructure like satellite communications and terrestrial communication systems. The reliability, performance, availability, and value of such systems are important issues that require to be addressed. This task outlines the foremost advances in state-of-the-art autonomous marine vehicles and systems utilized in a range of scenarios, from research to transportation. Additionally, this paper emphasizes how the technologies available may be assembled to function efficiently and effectively within the marine environment. It provides highlights of the trade-offs between autonomy and communication requirements, followed by an outline of promising communication and networking technologies that will facilitate the combination of autonomous systems into marine environment.

IoT in Agricultural methods to form it more efficient effective. Not a conventional approach to agriculture there are many inefficiencies, including livestock like higher human interaction, labour costs, power Consumption, water consumption, etc. This project will use a wireless sensor network Collect data from various sensors and Main server with wireless protocol. That's the info the knowledge collected during the method various environmental factors used for monitoring the full process. Environmental factors monitoring is not the solution to increase grain yield, quality and yield. Must be combined to develop something unique a system that handles all the factors that affect it Productivity of cultivation, harvesting, post-harvesting, etc. Autonomous systems are increasingly being employed in medicine. These autonomous systems are often individual medical devices, like surgical robots, or a mix of individual (medical) devices. Many manufacturers of medical devices and hospitals aren't fully conscious of it. The autonomous system represents a promising evolutionary area, especially from the point of view of research on artificial systems and embedded systems. The industry has many solutions for autonomous systems to resolve the answer to solution, but most of those solutions are unique. When maintaining the property of a selected technology, this ensures the market, which is incredibly expensive within the future. Because of the spread of your own solution, the robot industry presents high degree fragmentation, especially that there's an additional powerful number of applications from robot systems, today reduces the event of recent systems. Most topics that require to be addressed within the development of autonomous systems are common to all or any applications. For instance, these issues include, for instance, an outside / outdoor area localization, ability to avoid failure, and also the ability to create a straightforward decision. Specific events Therefore, it's clear that having a framework of tools that solves problems common to any or all application domains and launches for the event of latest, specific systems for specific tasks has significant advantages. Therefore, to be competitive in a very highly dynamic market, we want to shut a number of the gaps that are currently slowing the spread of autonomous systems. Lack of platforms to integrate components from different technology providers, lack of powerful embedded systems, and more. the shortage of platforms and methodological frameworks is simply one amongst the obstacles to beat. Changes in environmental conditions and water scarcity require systems that can effectively control irrigation. Autonomous irrigation systems have been developed to optimize the water use of crops. In a dry area or the places where there is little, rainfall Irrigation becomes difficult. Therefore, farmers need to remotely automate and manage to get the right yields safely. The purpose of this study is to identify soil moisture sensors and need of irrigation at that particular time. By this system we can schedule and plan sprinkling crops at perfect time. This review also describes the literature on remote sensors. This system also provides Communication with self-propelled sprinkler irrigation systems, distributed wireless sensor networks, sensors, integrated Data management scheme and autonomous sprinkler control options. Sensors distributed onboard and on-site can collect data from real-time irrigation management decisions and transmit that information directly or over wireless networks to the main control panel or base computer. Communications systems such as mobile phones, satellite radio, and internet-based communication systems

A system is also available that allows operators to contact the main control panel or base computer anytime, anywhere. The choice of communication system for remote access depends on the region and the terrain and cost of the region. Traditionally the irrigation system unnecessarily irrigates some parts of the field, while others may lack irrigation. New sensors or remote sensing capabilities are required to collect real-time data on crop growth and other parameters. It is related to weather, crops and soil to support intelligent and efficient irrigation management systems for agricultural processes. Further development of wireless sensor applications in agriculture is also needed to improve efficiency, productivity and farm profitability.

The agricultural zone drastically contributes to the financial increase of each country. This zone faces demanding situations with recognize to generating the proper amount and excellent of meals. Most conventional techniques utilized in developing vegetation are insufficient to making sure meals security. This assignment may be addressed with the aid of using making use of Information and Communication Technology (I.C.T.) withinside the agricultural zone. In the cultivation of vegetation, using right irrigation technique is critical in improving the increase and yield of vegetation.

This studies specializes in the utility of records generation to offer the specified quantity of water wished with the aid of using vegetation for increase. With the emergence of Internet of Things (IoT) which includes the interconnection of digital gadgets to the Internet and the purchase of statistics from those gadgets via the use sensors, an IoT primarily based totally Intelligent Irrigation System changed into built. The Intelligent Irrigation System consisted of a transmitter and a receiver circuit (that is linked to a water pump through an actuator).

India is an agriculture primarily based totally United States and it desires a clever and green manner of irrigation to save you wastage of water as water desk in lots of areas of the United States are already depleting at a extreme level. In this paper, implementation of a gadget which has a couple of sensors related to a manipulate module to alter outflow of water in an irrigation gadget is shown. The paper suggests a Raspberry Pi primarily based totally gadget which takes enter from sensors like humidity sensor, soil moisture sensor, barometer etc. to alter the water output to the irrigation discipline. Multiple sensors are scattered over the sphere. The sensors withinside the discipline sense the moisture of the soil and alerts it returned to the microcontroller. The manipulate module then irrigates the sphere in keeping with the water requirement primarily based totally at the sensor data. The version of an independent irrigation gadget additionally imposing machine getting to know is offered for rural areas. The intention of the independent irrigation gadget and its implementation is to correctly irrigate agricultural fields stopping water wastage. Index Terms: irrigation, soil moisture, sensor, agriculture, and farming. Modern methods follow low-level analysis and to a lesser extent. The sensor reduces the reliability of the whole process. Mistakes are made in the weather forecast. automatic watering Soil Moisture Detection System, System Soil moisture sensor, using temperature and humidity sensor Sensors that do not take into account various other parameters Like the topology of the Earth created by the gyroscope. It also uses cloud integration as shown in the following figure which depends on network stability but network connection in rural areas is unstable.

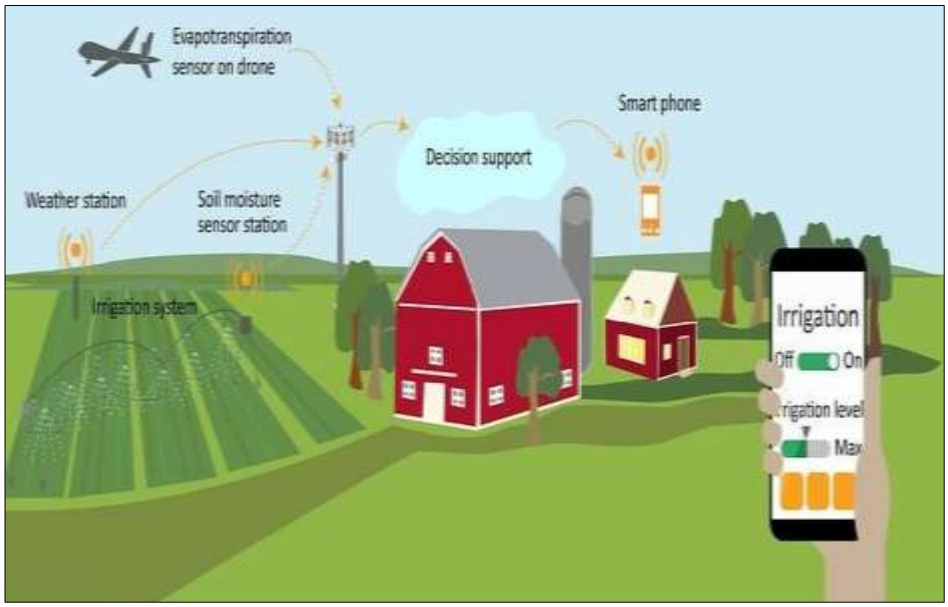

Fig 1: Automatic soil sensing mechanism

Proposed Work

Automated irrigation systems are reported to consist of: Two components (Fig (v)), the wireless sensor unit (WSU) and Wireless information unit (WIU) connected by radio transmitter allowing the transfer of soil moisture and temperature Data by implementing WSN using Zig Bee technology. T the WIU also has a GPRS module for transmitting data over the network. Information is online remote control via graphic application via internet access device by the mobile devices

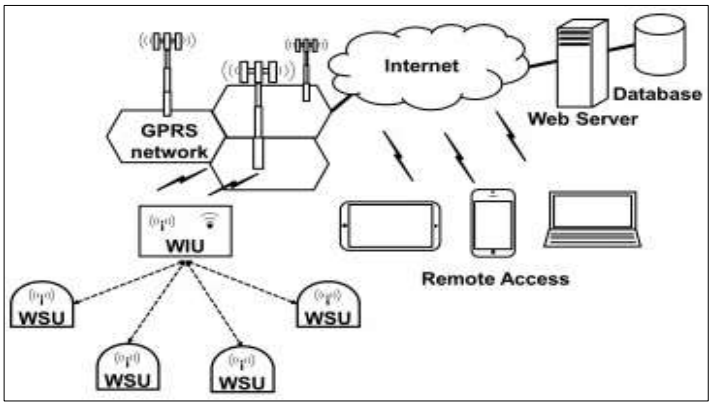

Fig 2: Configuration of the automated irrigation system. WSUs and a WIU, based on microcontroller, Zig Bee, and GPRS technologies

Wireless sensor unit

A WSU is constituted of a RF transceiver, sensors, a microcontroller, and electricity sources. Several WSUs may be deployed in-subject to configure a dispensed sensor community for the automatic irrigation system. Each unit is primarily based totally at the microcontroller PIC24FJ64GB004 (Microchip Technologies, Chandler, AZ) that controls the radio modem XBee Pro S2 (Digi International, Eden Prairie, MN) and approaches records from the soil-moisture sensor VH400 (Vegetronix, Sandy, UT), and the temperature sensor DS1822 (Maxim Integrated, San Jose, CA). These additives are powered via way of means of rechargeable AA 2000-mAh Ni-MH Cycle Energy batteries (SONY, Australia). The rate is maintained via way of means of a photovoltaic panel MPT4.8-75 (PowerFilm Solar, Ames, IN) to reap complete power autonomy. The microcontroller, radio modem, rechargeable batteries, and digital additives have been encapsulated in a water-resistant Polyvinyl chloride (PVC) container (Fig. vi). These additives have been decided on to reduce the electricity intake for the proposed application.

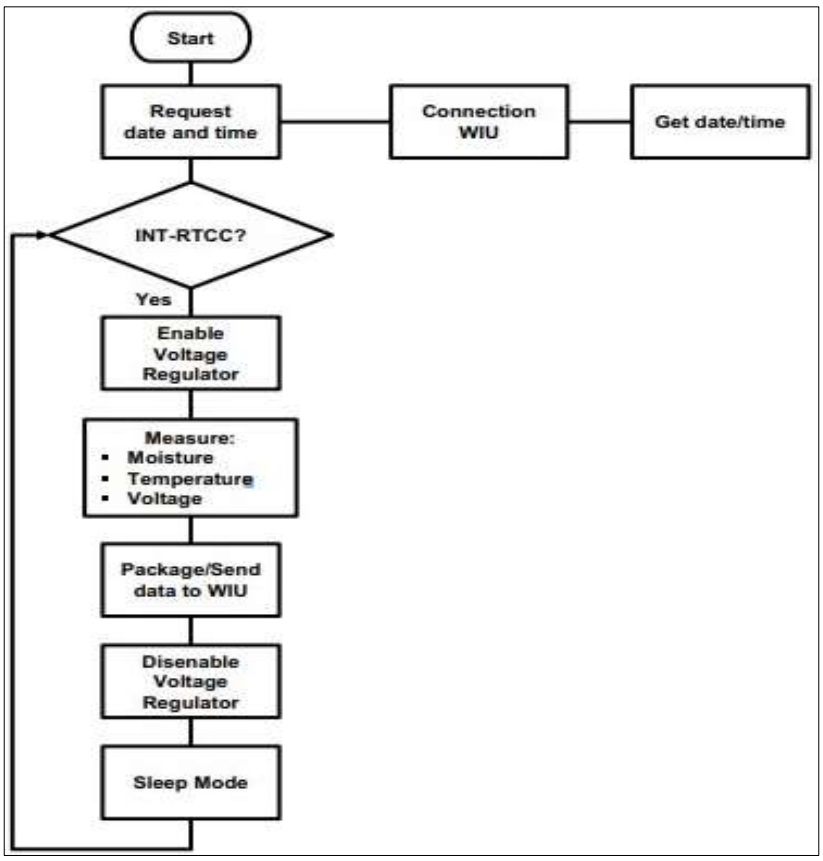

Fig 3: Algorithm of wireless sensor unit (WSU) for monitoring the soil moisture and temperature.

Mechanism

The automatic irrigation gadget hereby reported, consisted of components, Wi-Fi sensor units (WSUs) and a Wi-Fi records unit (WIU), connected via way of means of radio transceivers that allowed the switch of soil moisture and temperature WIU has additionally a GPRS module to transmit the statistics to a web server through the general public cell network. The records can be remotely monitored online thru a graphical application Through Internet get entry to devices. A) Wireless Sensor Unit:

A WSU is constituted of a RF transceiver, sensors, a microcontroller, and electricity sources. Several WSUs may be deployed in-subject to configure a dispensed sensor community for the automatic irrigation system. Each unit is primarily based totally at the microcontroller PIC24FJ64GB004 (Microchip Technologies, Chandler, AZ) that controls the radio modem X Bee Pro S2 (Digi International, Eden Prairie, MN) and approaches records from the soil-moisture sensor VH400 (Vegetronix, Sandy, UT), and the temperature sensor DS1822 (Maxim Integrated, San Jose, CA). These additives are powered via way of means of rechargeable AA 2000-mAh Ni-MH Cycle Energy batteries (SONY, Australia). The rate is maintained via way of means of a photovoltaic panel MPT4.8-75 (Power Film Solar, Ames, IN) to reap complete power autonomy. The microcontroller, radio modem, rechargeable batteries, and digital additives have been encapsulated in a water-resistant Polyvinyl chloride (PVC) container (Fig. vi). These additives have been decided on to reduce the electricity intake for the proposed application.

1) Single-Chip PIC24FJ64GB004: A 16-bit microcontroller with 44-pins and nano Watt XLP generation that operates in a variety 2.zero to 3.6 V at eight MHz with inner oscillator. It has up to twenty-five virtual input/output ports, 13-, 10-bit analogto-virtual converters (ADC), serial peripheral interface modules, I2C, UART, five 16-bit timers, sixty four KB of software memory, eight KB of SRAM, and hardware real-time clock/calendar (RTCC). The microcontroller is properly perfect for this far flung application, due to its low-energy working present day, that is one hundred seventy five µA at 2. five V at eight MHz and zero. Five µA for standby present day in sleep mode which include the RTCC. The microcontroller turned into

programmed in C compiler 4.12 (Custom Computer Services, Waukesha, WI) with an appropriate set of rules (Fig. 3) for tracking the soil-moisture probe via an analog-to-virtual port and the soil-temperature probe via any other virtual port, applied in 1-Wire conversation protocol.

A battery voltage reveal is protected via a high-impedance voltage divider coupled to an analog-to-virtual port. The records are filled with the corresponding identifier, date, and time to be transmitted thru X Bee radio modem the usage of a RS-232 protocol via virtual ports configured as transmitter (TX) and receiver (RX), respectively. After sending records, the microcontroller is ready in sleep mode for sure duration consistent with the sensor sampling charge desired, while the inner RTCC is running. This operation mode lets in power savings. When the WSU is released for first time, the set of rules additionally inquires the WIU, the date and time to software the RTCC, and periodically updates it for synchronization.

WSU requiring date/time frame:

Start	LSB of the XBee						
R	D7	D6	D5	D4	D3	D2	D1	D0

WIU sending date/time frame:

Date/Time					
Second	Minute	Hour	Day	Month	Year

R: Request date/time to WIU
S: Send data to WIU
ID: WSU identifier
MSB: Most Significant Byte
LSB: Least Significant Byte

WSU sending data frame:

Start	Identifier	Time/Date						Temperature		Moisture		Battery Voltage	
S	ID	ss	mm	hh	DD	MM	YY	MSB	LSB	MSB	LSB	MSB	LSB

Fig 4: Showing description about WSU

2) ZigBee Modules: ZigBee (over IEEE 802.15.4) generation is primarily based totally on brief variety WSN and it became decided on for this battery-operated sensor community due to its low cost, low strength consumption, and more beneficial variety in comparison with different wi-fi technology like Bluetooth (over IEEE 802.15.1), UWB (over IEEE 802.15.3), and Wi-Fi (over IEEE 802.11) [67]. The ZigBee gadgets perform in industrial, scientific, and scientific 2.4-GHz radio band and permit the operation in a so-referred to as mesh networking architecture that could be differentiated into 3 categories:

1) Coordinator; 2) router; and 3) stop tool.

From a huge variety of industrial ZigBee gadgets, the XBee-PRO S2 is the ideal authentic system producer module to set up conversation among a WSU and the WIU due to its long-variety operation and reliability of the sensor networking architecture. The XBee PRO S2 is a RF modem with incorporated chip antenna, 20-pins, and thirteen general reason input/output (GPIO) ports to be had of which 4 are ADC. It can perform as much as a distance of 1500 m in outdoor line-of-sight with a 100 and 70 mA of TX top contemporary and 45 mA for RX contemporary at 3.3 V and strength-down contemporary of 3.5 µA. The XBee radio modem of every WSU is powered at three. Three V via a voltage regulator ADP122AUJZ-3.3-R7 (Analog Devices, Norwood, MA) and interfaced to the host microcontroller via its serial port, a logic-degree asynchronous serial, and voltage likeminded UART configured at 9600 baud rate, no - parity, 1 - begin bit, 1 - prevent bit, 8 - records bits. The WSUs have been configured consisting of stop gadgets to deploy a networking topology factor-to-factor primarily based totally on a coordinator that became carried out via way of means of the XBee radio modem of the WIU. A stop tool has the subsequent characteristics:

1. It need to join a zigbee PAN earlier than it is able to transmit or acquire records;
2. Cannot permit gadgets to enroll in the community;
3. Need to usually transmit and acquire RF records via its parent;
4. Cannot course records; and
5. Can input low strength modes to preserve strength and may be battery powered. The least full-size byte of the particular 64-bit deal with is used to label the records of the soil moisture and temperature for every WSU with inside the community. This byte is registered with inside the WIU because the identifier (ID) related to every WSU. As proven with inside the pattern frames to request date/time, acquire date/time, and ship records packaged to the WIU.

3) Soil Sensor Array: The sensor array includes soil sensors, along with moisture and temperature which might be inserted with inside the root sector of the plants. The probe measures the dielectric steady of the soil the usage of transmission line strategies at 80 MHz, that's insensitive to water salinity, and presents an output variety among 0 and 3.0 V, that's proportional to the volumetric water content (VWC) consistent with a calibration curve furnished through the manufacturer. The sensor turned into powered at 3.3 V and monitored through the microcontroller via an ADC port. Soil temperature measurements had been made via the virtual thermometer DS1822. The sensor converts temperature to a 12-bit virtual phrase and is saved in 2-B temperature registers, similar to increments of 0.0625 °C. The temperature is needed via a studying command and transmitted the usage of 1-Wire bus protocol applied with inside the microcontroller via one virtual port. The thermometer has ±2. 0 °C accuracy over −10 °C to +85 °C temperature variety and a completely unique 64-bit serial number. The sensor is a three-pin single-chip and TO92 bundle that turned into embedded in a steel tablet and sealed in a water-proof PVC cylindrical container. To calibrate the soil moisture, numerous samples had been organized with 1 kg of dry soil from the crop area. Its composition turned into loamy sand with eighty% sand separate, 4.5% clay separate, and 15.6% silt separate. The soil water protecting ability turned into of 20.7% VWC similar to measured output voltages of 1.45 V. The temperature sensors had been

calibrated via a reference mercury thermometer CT40, with 0.1 °C divisions and a variety from −1 °C to 51 °C. The thermometer and the temperature sensors had been located in an insulated flask full of mineral oil at 10 °C and 40 °C.

4) Photovoltaic Cell: To hold the price of the WSU batteries, a sun panel MPT4.8-75 turned into employed. Each sun panel gives you 50 mA at 4.8 V, that's enough strength to hold the voltage of the 3 rechargeable batteries. A MSS1P2U Schottky diode (Vishay, Shelton, CT) is used to save you the sun module and to empty the battery while is with inside the dark. The sun panel is encapsulated in a three mm clean polyester movie with dimensions of 94mm × 75 mm. This bendy panel turned into installed on a PVC prismatic base (100mm × 80 mm × 3.17 mm) this is fixed with inside the higher a part of a PVC pole taking into account the precise alignment of the photovoltaic panel to the sun. The stick is 50 cm of period and 12.5 mm of diameter; the decrease give up of the pole had a tip give up to be buried.

B) Wireless Information Unit

The soil moisture and temperature facts from every WSU are received, identified, recorded, and analyzed with inside the WIU. The WIU includes a grasp microcontroller PIC24FJ64GB004, an XBee radio modem, a GPRS module MTSMC-G2-SP (Multi Tech Systems, Mounds View, MN), an RS-232 interface MAX3235E (Maxim Integrated, San Jose, CA), digital relays, 12 V dc 1100 GPH Live well pumps (Rule-Industries, Gloucester, MA) for riding the water of the tanks, and a deep cycle 12 V at 100-Ah rechargeable battery L-24M/DC-140 (LTH, Mexico), that's recharged with the aid of using a sun panel KC130TM of 12 V at one hundred thirty W (Kyocera, Scottsdale, AZ) via a PWM rate controller SCI-120 (Sys com, Mexico). All the WIU digital additives have been encapsulated in a waterproof PVC field as proven in Fig. The WIU may be positioned as much as 1500-m line-of-sight from the WSUs positioned with inside the field.

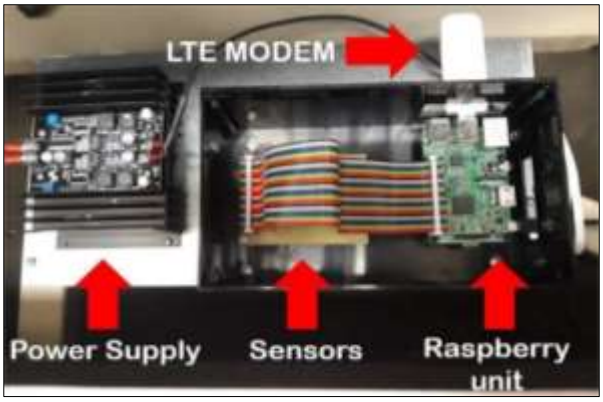

Fig 5: The WIU may be positioned as much as 1500-m line-of-sight from the WSUs positioned with inside the field

Conclusion

The computerized irrigation machine carried out became discovered to be possible and price powerful for optimizing water resources for agricultural manufacturing. This irrigation machine permits cultivation in locations with water shortage thereby improving sustainability. The computerized irrigation machine evolved proves that the use of water may be dwindled for a given quantity of fresh biomass manufacturing. The use of sun energy on this irrigation machine is pertinent and appreciably vital for organic plants and different agricultural merchandise which are geographically isolated, in which the funding in electric powered energy deliver would be expensive. The irrigation machine may be adjusted to loads of specific crop desires and calls for minimal maintenance. The modular configuration of the automatic irrigation machine permits it to be scaled up for large greenhouses or open fields. In addition, different packages together with temperature tracking in compost manufacturing may be without difficulty carried out. The Internet controlled duplex communique machine presents a effective decision making tool idea for model to numerous cultivation scenarios. Furthermore, the Internet hyperlink permits the supervision via cellular telecommunication devices, together with a smartphone. Besides the financial savings in water use, the importance of the maintenance of this herbal useful resource justify the use of this type of irrigation systems. This paper specializes in enforcing standalone offline machine for imparting a self-sustaining machine for irrigation. There are more than one regions of development which include locating out a green technique to improve the machine as an offline machine poses the hassle of loss of self-getting to know and robustness after a length of time. Some type of arrangement may be achieved to make a hybrid machine which periodically enhancements the machine code at the manage module thru cloud however the inclusion of one of these module with inside the proposed machine will upload to the value and the value effectiveness of the proposed machine can also additionally decrease. Further, more than one module may be brought to make it an entire clever agriculture machine in place of simply specializing in irrigation machine.

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