ISSN: 2454-9940

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

E-Mail :
editor.ijasem@gmail.com
editor@ijasem.org

www.ijasem.org

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

ISSN 2454-9940

www.ijasem.org

Vol 18, Issue 2, 2024

Agricultural Security and Smart Irrigation Systems

Mr. Gandham Srinivasa Rao, Ms. P. Naga Laxmi, Ms.Y.Anitha, Mrs. S. Madhavi

[1,2,3,4] ASSIT.PROFESSOR

Department of ECE, SWARNA BHARATHI INSTITUTE OF SCIENCE & TECHNOLOGY (SBIT), Pakabanda Street, Khammam - 507 002. Telangana, India.

Abstract

These days, technology permeates every industry that employs it. Smart technology, including devices and applications, is essential for the orchestration and coordination of activities worldwide. Smart, cost-effective technology may be important for agriculturists in maintaining healthy crops and operating their businesses. Based on readings from soil moisture sensors, the proposed concept employs a smartphone-controlled smart watering system that operates autonomously. A number of surveillance cameras will be set up to monitor the crops and document any changes in their growth or condition. As an added layer of security, these cameras may be accessed via the owner's phone in case of an invasion or break-in. As an additional safety measure, an ultrasonic sensor has been set up to cover the whole area and notify the owner in the event that someone gains unauthorised access to the field. The proposed approach is an easy-to-implement strategy for health and safety monitoring that farmers may use to enhance the percentage of crops that are grown and harvested.

KEYWORDS

A security system, wifi module, phone-based control, smart irrigation system, and smart agriculture are all related terms.

Introduction

Many people see agriculture as the lifeblood of an economy and the foundation of a healthy country. Farming is very important and impacts our daily lives since it not only produces food but also employs people. Agriculture groups have reported that damage percentages in agricultural cultivation have reached a shocking 40% in total crop output. A plant's transpiration and evaporation, the transfer of heat and water from the air to the ground, are both influenced by the moisture content of the soil. Soil moisture is essential for agricultural growth, and one of the main issues that reduces crop productivity is the inadequate water supply. Because plants thrive in wet soil and with just the right amount of water, soil moisture is a crucial component of every successful farming operation. It is possible to harm crop development and cultivate an excessive quantity each year if these soil moisture needs are not met. It is neither possible nor economically viable to alter cultivation techniques at the appropriate pace since crop cultivation is done over months. As a result of their crop falling short of the real needs for a steady livelihood, farmers yearly incur large loan obligations and are unable to repay these loans.

Real or imagined, these figures may have a profound effect on a farmer's livelihood, what with crop loss topping US$18 billion and loan debt reaching into the billions for farmers throughout the globe. Consequently, there has to be an instant implementation of a cost-effective way to assist modern farmers in cultivating crops that boost their growth

ISSN 2454-9940
www.ijasem.org
Vol 18, Issue 2, 2024

percentages.

The suggested approach uses both software and hardware to make farming easier, similar to how smart devices are being used in every industry. Here, the suggested smart agricultural system involves controlling the crops' safety and health using smartphone apps. The purpose of a plant monitoring system is to ensure that the soil is not overly watered but rather has sufficient access to water by checking the moisture content of the soil and alerting the owner through an app on their phone. The owner can also control the irrigation or water flow into the soil automatically using their phone. Even if farmers' harvests are successful, they may still face danger from outside forces in the form of trespassers, who take their crops while they're still in good condition and generally commit larceny. The suggested solution allows us to pinpoint the precise moment when the cultivating field is invaded by the figure, as well as the precise position of the figure, by means of an app that notifies the owner. Here, there are a number of uses for installing a network of surveillance cameras over the field; these cameras will allow the owner to keep tabs on the crop's progress and health at all times, even when they aren't physically there. Quick action may be done to cure crop growths affected by illnesses or to send them to an expert for a competent treatment.
The installed cameras may also be used to confirm whether someone is breaking into the property. whether the owner gets a notification, they can watch the intruder and decide whether to take urgent action if they are on the property without permission.

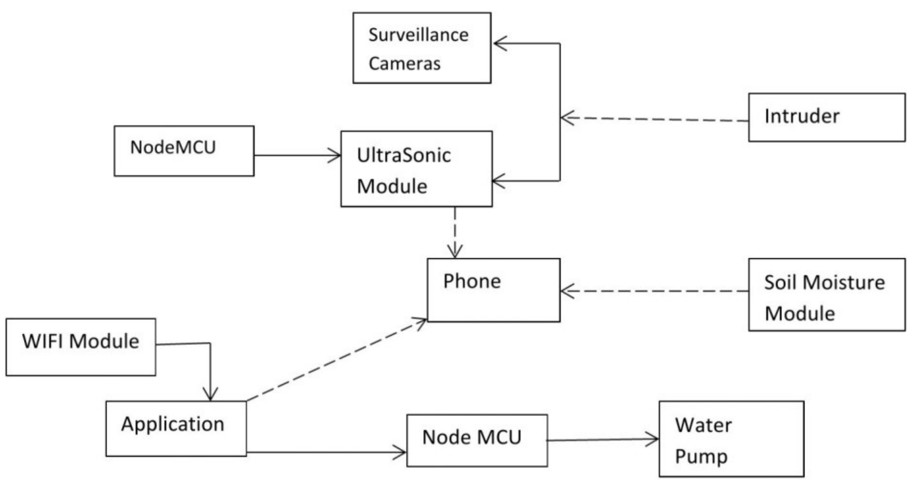

Figure 1. Smart irrigation system and agricultural security architecture

1. Hardware Architecture

Hardware architecture of Agriculture security and Smart irrigation system consists of various hardware parts: Moisture sensor, Node MCU, Wifi Module, Relay Module, Water pump valve, FTDI module, ESP32 Cam and Ultra Sonic sensor. The architecture of the proposed system as a whole is shown below in Fig 2.

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT
ISSN 2454-9940
www.ijasem.org
Vol 18, Issue 2, 2024

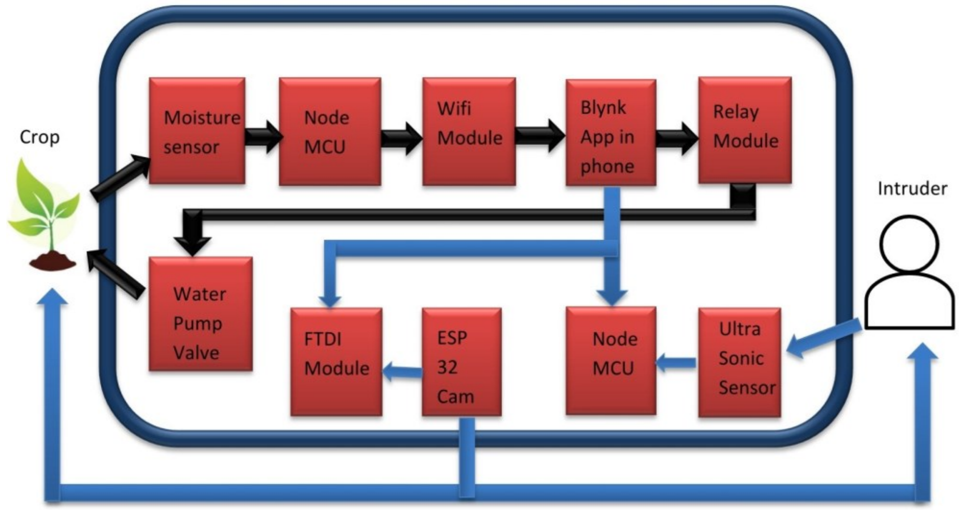

Figure 2. Hardware Architecture

One way to find out how much water and humidity is in the soil around your crops is to utilise a soil moisture sensor. Soil moisture sensor is linked to Node MCU. Node MCU has four Wi-Fi modes, so it can connect to an existing network, configure its own network, and let other components join. It can also operate as an access point, connecting to another network or acting as a station device. We use the node MCU as the Wi-Fi module in this case so that all of the components may connect to the network using the same SSID and password, as our whole system relies on this module. Along with the network's SSID and password, the Blynk app on our smartphones is linked to the same IP address. In response to readings from the soil moisture sensor, this app notifies users of the current soil moisture level; using this data, smart irrigation can be activated with the touch of a phone screen, activating a water pump valve linked to a relay module that draws water from a tank and automatically supplies the field with sufficient water through a pipe. In order to identify crops that are healthy and those that aren't, ESP32 Cams are employed in surveillance systems and to watch live footage of the crops' development. This is where the compiled programme is loaded utilising the FTDI Module and TTL serial connections to and from USB signals. All of these camera modules share the same network, so you can track your crop's progress using the Blynk app.

Ultrasonic sensors, which are part of the security system here, may detect any unapproved individuals, whether they be humans or animals, in the field. Additionally, ultrasonic sensors that cover the entire field function as a kind of ultrasonic radar, transmitting data to the Blynk app on our phones in the event of an intrusion or breach. These sensors are linked to the same Wi-Fi module through Node MCU, and we receive alerts regarding these events. We may use our smartphones linked to the same Wi-Fi module to access the function that allows us to identify the origin of a security breach, and multi-surveillance cameras serve several purposes, such as monitoring crop development.

1.1. Hardware Implementation for the Irrigation System

A cheap single-board microcontroller, the Node MCU serves as the circuit's wifi module. If you're using NodeMCU, you'll have GPIO. The amount of water in soil may be measured by using soil sensors. For digital signals, DTH 11 is the way to go.

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

ISSN 2454-9940

www.ijasem.org

Vol 18, Issue 2, 2024

of both temperature and humidity, this is known as humidity sensing technology. One signal may activate many circuits using a relay module; in this case, the water pump valve. The module is linked to a 12v battery. A solenoid valve controls the amount of water that may be sent to the ground.

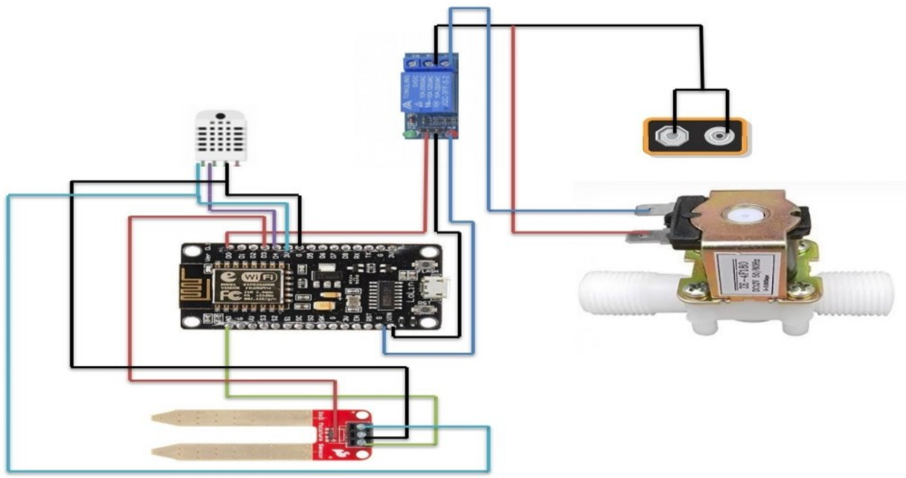

Figure 3. Irrigation system circuit implementation

D3 of node MCU or GPIO 0 is given to 01C/01A of sensor, 3V3 acts as the voltage source given to VCC of sensor, AO of node MCU is supplied as input signal port SIG to soil sensor, GND of node MCU is connected to GND of sensor.
DO or GPIO 16 is supplied to relay module VCC, with VIN provided to input port and GND provided to ground port of relay module. Normally Closed port is connected to one part of solenoid water valve, while common contact is supplied to 12V battery for power supply, which also powers the water pump valve. 3V3 provides source voltage at port VCC of DTH11, D4 or GPIO 2 is supplied to DATA of DTH11, with GND terminal connected to GND port.

1.1. Surveillance System Proposed Hardware Implementation

ESP32 cam is a low power system and also low cost with integrated Wi-Fi and even Bluetooth. It provides a 3.3 V DC supply, it is a microcontroller with 44 programmable GPIO pins. FTDI module is a semiconductor device and it specializes in USB technology. It converts various signals from USB to other form of communication such as the program stored in module.

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

ISSN 2454-9940
www.ijasem.org
Vol 18, Issue 2, 2024

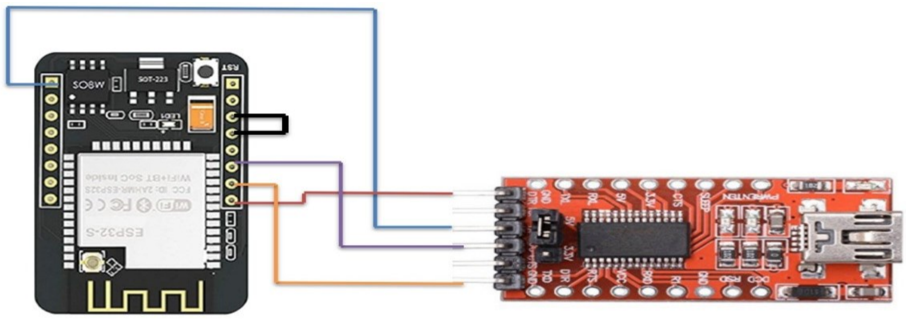

Figure 4. Surveillance system circuit implementation

3.3V Dc supply from ESP is connected to port TX or also known as transmit. GPIO12 and GPIO13 are interconnected within the camera module. DTR is supplied to GPIO 4, VCC of the ftdi is supplied to GPIO14. GND of the FTDI is connected to the GND port of ESP32CAM.

1.2. Ultrasonic Sensor System Proposed Hardware Implementation

Using Node mcu as a wifi module for ultrasonic sensor, these sensors are also called as transceivers because they send and receive back the radio or sound waves from the target, these sensors can be applicable as radar or even sonar material and works at the same principle. Radar method can also be implemented as it covers the entire field and displays in a 180 degree angle determining the exact location of the figure. Distance is also given to the smartphone with sending and receiving of the waves by the sensor.

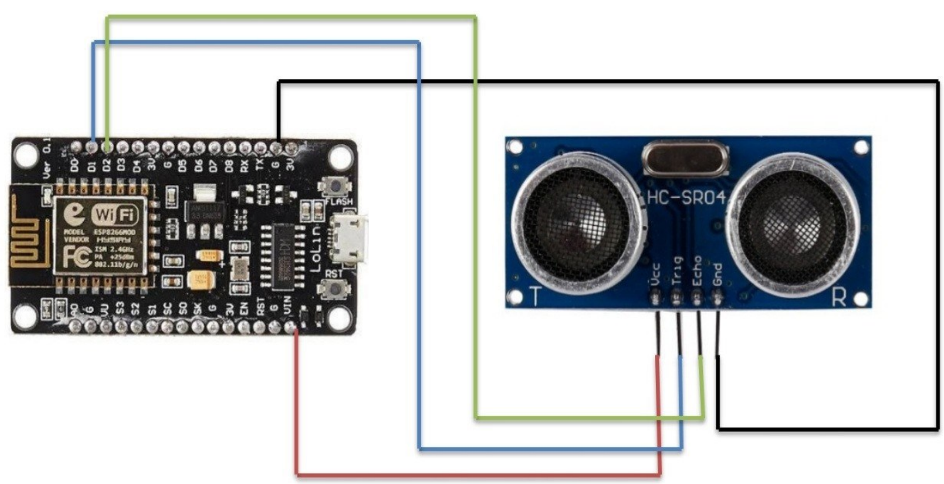

Figure 5. Ultrasonic Sensor circuit implementation

GPIO5 or D1 of the NODEMCU is connected to Input pin or trigger pin of the sensor. Output Pin of the sensor or Echo pin is supplied to GPIO 4 or D2.

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT
ISSN 2454-9940
www.ijasem.org
Vol 18, Issue 2, 2024

GND pin is supplied to GND of sensor. VCC or 5V power supply is given to VIN of the NODEMCU.

2. Work Flow of Proposed System

2.1. Workflow of Smart irrigation

Workflow of smart irrigation system is shown in Fig 6, the soil moisture sensor determines the water content levels present in the soil that is around the crops whether the moisture level is sufficient or insufficient information is sent to the Blynk app installed in our phones. Notification of insufficient levels allows us to take action of supplying water through solenoid water valve. The process of this information being sent to our smartphone and the control of the water valve through the app is possible through the implementation of NodeMCU which acts as the wifi module for the circuit, upon which this network is accessed by the blynk app with the network's same SSID and Password. Automatic water levels

which is connected through relay module to Node MCU. Hence, a tap on the smart phone switches on the water valve to supply water through the field. In case of sufficient water levels, the readings are shown to be normal hence no further process is required. During insufficient water levels the process is carried out until the soil moisture reaches the adequate levels of water content levels that is required to grow crops.

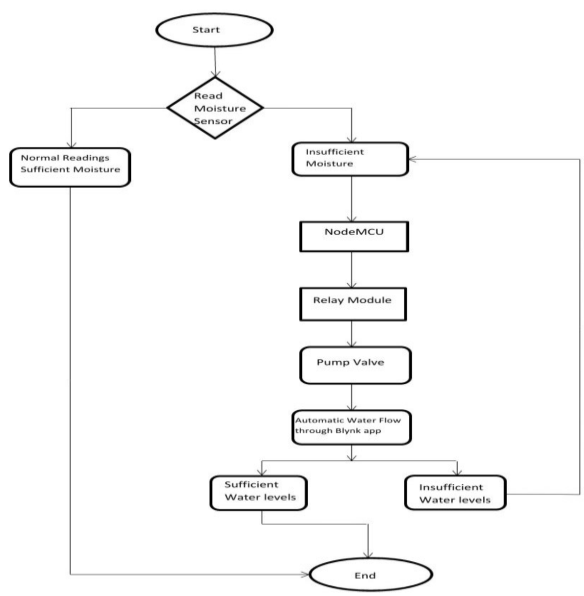

Figure 6. Workflow of Smart irrigation system

2.2. Workflow of Surveillance System

Surveillance system workflow is shown in Fig 7, mutli camera system comes to various use in this system as they can be used to monitor the crop growth as well as security system to determine the breach. ESP32 cams are also connected to the common network sharing the same SSID and password as our blynk app in the smartphone. When the security

ISSN 2454-9940
www.ijasem.org
Vol 18, Issue 2, 2024

system sends an alert message to the phone, the owner can use the access of multi surveillance system to notice the unauthorized figure or this feature checks out the crop healthy growth. The image of unhealthy crop can be captured from our phone being away from the field and can be used to recognize the problem that ails the crop or the image can be sent to official crop health caretakers or experts. This system allows us to maintain a systematic monitoring of the crop growth and health without having the need of physical presence in the field. These cameras are also used to determine the authorized figure that breaches the fields and damages or steals the crops, such as robbers or animals. The image is immediately captured upon the owner's access on the phone since these cameras cover the entirety of fields the image is shown covering the units inside the field. The ftdi module loads the program stored and transmits signals to the ESP32 cam which is already connected to blynk app in our smartphones, hence the image captured takes place immediately.

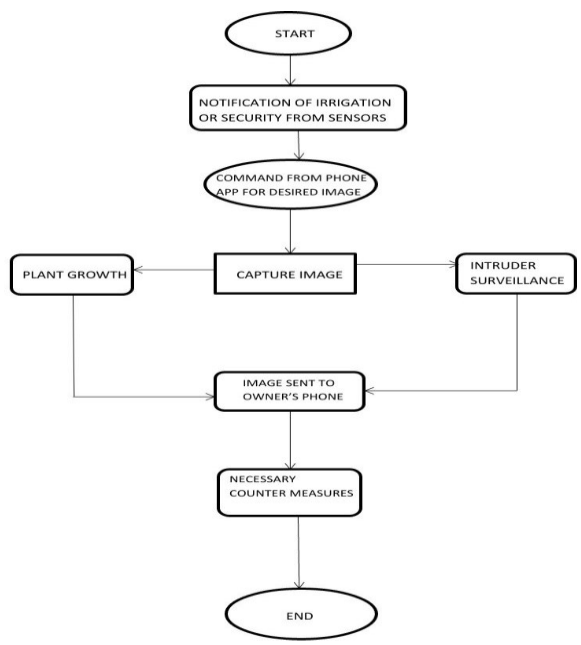

Figure 7. Workflow of Surveillance system

3.3 Workflow of Ultrasonic Sensor

Ultrasonic sensor workflow is given in Fig 8, ultra sonic sensor transmits the radio or sound waves which measures the distance of the figure based on the time and speed it takes for this waves to reach back the sensor. When the sonic sensor detects an object or figure in the field, it immediately sends a notification about the location and distance of the figure across the field. We can use this feature as a security system that spreads across the field and immediately sends notification upon breach. Further we can also multi surveillance system to determine who or what breached the field and what they are attempting to do. Since the ultrasonic sensor is connected to NODEMCU it immediately sends the location of the robber of animal in the field to the owner within blynk app installed in their smartphones. Hence this feature always monitors the field as a security system and immediately notifies the owner at all times and anywhere around the world, the owner doesn't have to be near the fields and keep watch at all. This proposed system will automatically inform the owner about the intrusion.

ISSN 2454-9940
www.ijasem.org
Vol 18, Issue 2, 2024

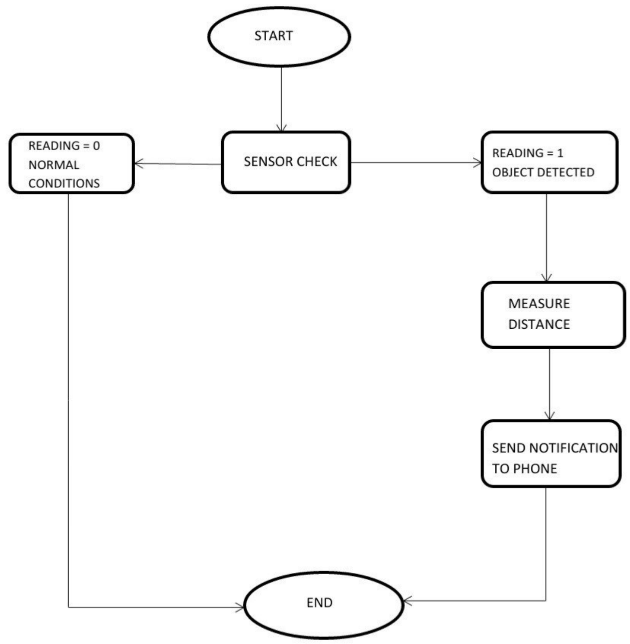

Figure 8. Workflow of Ultrasonic sensor

3. Conclusion

Every industry that manufactures shared products relies heavily on smart devices. The crops grown in a nation are a reflection of its most important economic asset. The security of these cultivated areas and sufficient irrigation or water requirements are of paramount significance since agriculture is the most crucial component for a country's progress. By allowing users to obtain agricultural land information via their smartphones, the suggested method is both cost-effective and advantageous; this, in turn, minimises the need for humans to be physically present on the property. To prevent crop theft and rotting, ultrasonic sensors are placed throughout the fields. When these sensors detect an incursion, they work in tandem with many surveillance cameras to take appropriate action. With an automated water irrigation system, farmers can save a tonne of time and effort by just tapping a button on their smartphone to provide water at precisely the right quantities for their land. The proposed method improves security while decreasing the need for human workers, thanks to the superior accuracy and efficiency of robots. Therefore, this system may be implemented right away due to its low cost and ease of use.

4. References

In 2019, Maxey-Vesperman, Goldasich, and Tewolde published a study. Smart System for Monitoring Plant Life. "2019 IEEE 16th International Conference on Smart Cities: Improving Quality of Life Using ICT & IoT and AI (HONET-ICT)" The publication's DOI is 10.1109/honet.2019.8907989.

It was published in 2020 by Jayam, Y. Kumar, Tunuguntla, V., B, S. J., and Harinarayanan, S. Smart Plant Managing System utilising IoT. "ICOEI" (48184), the 4th International Conference on Trends in Electronics and Informatics, 2020. The given DOI is: 10.1109/icoei48184.2020.9142980.

ISSN 2454-9940
www.ijasem.org
Vol 18, Issue 2, 2024

This information is sourced from a study by Jariyayothin et al. (2018). IoT Backyard: Intelligent Watering Management System. The 2017 ICT International Student Project Conference (ICT-ISPC) was held in 2018. 10.1109/ict-ispc.2018.8523856 is the DOI for

The authors of the cited work are Pezol, Adnan, and Tajjudin (2020). A Smart Irrigation and Fertilisation System for Chilli Plants Based on the Internet of Things (IoT) and Fuzzy Logic. Conference on Intelligent and Automatic Control Systems (I2CACIS) 2020, sponsored by the IEEE. DOI: 10.1109/i2cacis49202.2020.9140199.

Bhuyan, Lovell, and Bigdeli (2007) were cited as [5]. Multi-Camera Tracking for Video Surveillance. conference on digital image computing techniques and applications (DICTA 2007) held by the Australian Pattern Recognition Society during its 9th biennial conference. DOI: 10.1109/dicta.2007.4426852.

(n.d.) Ellis, T. [6]. Interconnected video surveillance systems. Proceedings. Second International Carnahan Conference on Security Technology, 36th Annual 2002. finder. doi:10.1109/ccst.2002.1049256.

[7] In a 2019 publication by Alshammari and Rawat. Smart City Applications for Intelligent Multi-Camera Video Surveillance Systems. A conference and workshop on computing and communication, the 2019 IEEE 9th Annual (CCWC). the working paper has the DOI of 10.1109/ccwc.2019.8666579.

As stated in a 2012 publication by Behera, Kharade, Yerva, Dhane, Jain, and Kutty, the authors count eight authors. system that uses many cameras for monitoring. International Conference on Information and Communication Technologies in 2012. The given DOI is: 10.1109/wict.2012.6409058.

[9] Benfold, B., Bibby, C., Reid, I., Roth, D.,... Gonzalez, J., and Bellotti, N. (2009). A network of cameras designed for monitoring at different levels of detail. International Conference on Distributed Smart Cameras, Third Edition (ICDSC), 2009, sponsored by ACM and IEEE. the publication number is 10.1109/icdsc.2009.5289413.

[10]In 2020, Yadahalli, Parmar, and Deshpande published a study. Protect Your Crops with an Arduino-Based Intelligent Intrusion Detection System. Two-Day International Conference on Innovative Research in Computer Applications (ICIRCA) in 2020. Publication date: 10.1109/icirca48905.2020.9182868.