Real Time Monitoring of Smart City and Farming based on Internet of Things

Ashwanth.S[1], Yamuna.S[2], Gokula Brindha.S[3], Sreedhar.M[4], Menakambal.S[5]

[1,2] *Assistant Professor, Department of ECE/ Velalar College of Engineering and Technology, Erode, India.*
[3] *Assistant Professor, Department of EEE/ Velalar College of Engineering and Technology, Erode, India.*
[4] *Professor, Department of EEE/ Velalar College of Engineering and Technology, Erode, India.*
[5] *Teacher, The Indian Public School, Erode, India.*

ABSTRACT

All facets of human life have been changed and made more comfortable by the Internet of Things (IoT) technology. IoT is the term used to describe the present trend of linking all types of physical things, even the most unexpected ones, to the Internet without the need for human interaction, creating a self-configurable network. Through the use of Internet technology and data transmission to the cloud, the Internet of Things (IoT) enables businesses to automate the procedure and enhance service delivery. The Internet of Things (IoT) is currently a hot issue among academics, professionals, and experts. It is seen as the next phase in the Internet's development. This paper discusses the use of (IoT) technology in several fields, including agriculture and smart cities.

Keywords*: Internet of Things, Smart City, Smart agriculture*

I. INTRODUCTION

Internet of Things (IoT) originally emerged in a lecture by British engineer Kevin ASHTON in 1999. It was used to describe a network of physically linked items to the Internet. The phrase has grown to include the full ecosystem of linked items over time. The Internet of Things (IoT) is now a hot issue among academics, professionals, and experts. It is seen as the next phase in the Internet's development. With the IoT, we are moving closer to a day where every component of our environment will be online and able to speak with one another with little to no human intervention. There are many different items in the IoT that can be linked to wired and wireless networks. These items have an addressing system that enables them to communicate and work together to develop new Internet of Things (IoT) services and applications, including smart homes, smart cities, smart energy and networks, smart transportation, and traffic management and control.

It is now possible to enhance living conditions and make the best use of all resources thanks to the development of numerous sensors and software programmes that interpret information from the sensors. With the aid of numerous IoT-supported technologies, a person may monitor and control his surroundings, behaviours, and define his daily demands. Reducing the user's engagement in their everyday tasks is the key advantage of implementing IoT. If the sensor can detect darkness, why does the user need to turn on the light? a straightforward illustration of how the usage of several sensors and software tools that gather data from the sensors may enhance user experience and fulfil certain requirements. The term "smart city" refers to an area where public resources are utilised more effectively, services provided to inhabitants are of higher quality, and administrative expenses are decreased.

The administration and optimization of public services, including transportation, parking, lighting, security, upkeep of common spaces, protection of cultural property, and garbage collection, may benefit from the IoT in a number of ways. Also, people may leverage the availability of many sorts of data gathered by IoT devices to increase awareness of the state of their community. The use of IoT in agriculture enables the enhancement of the production process as well as the monitoring and upkeep of planted areas. The capacity to manage systems and operate operating land cultivating machinery from a distance is one benefit of applying cutting-edge technology. The requirement for human participation in a broad range of activities is reduced by the adoption of suitable software architecture (such as improving the already used software architecture) that can enable the usage and control of sensors in agriculture. IoT is crucial to the development and deployment of a broad variety of applications in the area of smart health, including the tracking of patient behaviour changes and the observation of treatment outcomes. Smart health enables people (such as doctors, nurses, patient carers, family members, and patients) to access the appropriate information and receive the appropriate solutions, which are primarily intended to reduce errors, increase efficiency, and lower costs in the medical field at the appropriate time.

II. SMART PARKING

A. System Components

A smart parking system (Smart Parking) has been developed for the smart city domain to discover an open parking spot in the parking areas without requiring human efforts and so eliminate the requirement to waste fuel and time on efforts. The availability of parking spots is determined by a number of sensors placed throughout the parking area, and users may simply obtain this information by using the Internet. The built smart parking prototype can determine if a parking space is empty or occupied. The information/data gathered by the sensors is transferred to the cloud, where the user may access it via the Android application seen in figure 2.1.

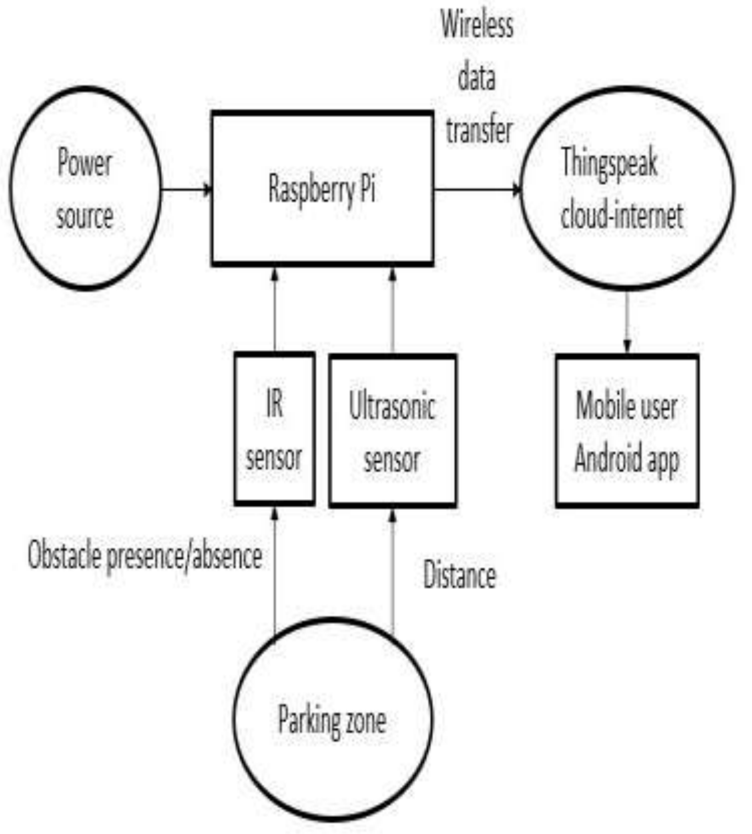

Figure 2.1 Architecture of smart parking system

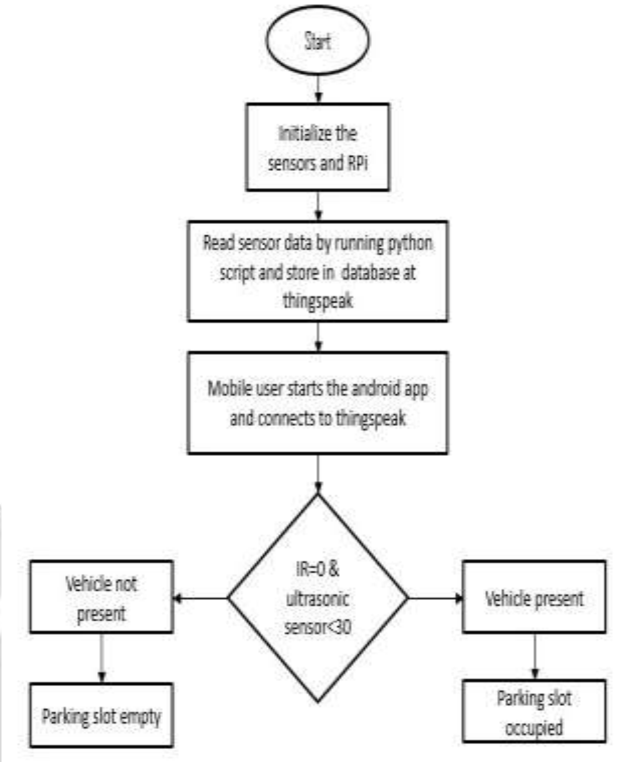

Figure 2.2 Diagram of smart parking system

The following steps are performed:

- The Raspberry Pi's ultrasonic sensor and infrared sensor are used to measure the availability of a parking place.
- Data is transferred to "ThingSpeak" via the internal wi-fi of the Raspberry Pi after being measured to determine if an obstruction is there or not.
- The information is kept in the ThingSpeak cloud. The information is presented visually.
- A user's mobile app connects to the cloud and gives data about parking spots (free or occupied).

B. Discussion

One of the advantages of the IoT application suggested is the Smart Parking System, which can locate a vacant parking space in the parking lots without the use of manual labour, saving time and fuel. However, this prototype did not take into account online reservations with payment, necessitating the need to improve it as follows:

The user must query the system to see whether a space is available before making a reservation online. The user will be sent to the payment page after selecting a slot from the system's display of the database's available slots. If the transaction is successful, the user will get a barcode, and the database will be updated.

To enter the parking space, the barcode will be scanned. The doors won't open if there is no barcode. If there are no open spaces, the parking system will also provide an offline reservation. In this instance, the user must pay manually at the gate, after which their display screen will reflect the available spots. A display screen, a barcode scanner, and a DC motor to open the door will all be located at the entry.

Also needed are secure mobile applications that users can administer and secure online applications that the administrator can manage. The hardware when we can add a motor, a display screen, and a barcode scanner to open the door and to save time and fuel we can add GPS to indicate the free parking spaces in our smart parking. This will increase the functionality of our system. We will switch the smart city domain to the farm domain and analyse the IoT application produced in accordance with the research of IoT smart parking application offered.

III. SMART AGRICULTURE

A. System components

It is well known in the agricultural industry that farmers' fields may be found miles from their residences. Farmers may need to visit their fields numerous times each day to start and stop the water (irrigation pumps). They are unable to consistently shield the crops created a technique to handle all of these issues automatically in order to get over these practical challenges.

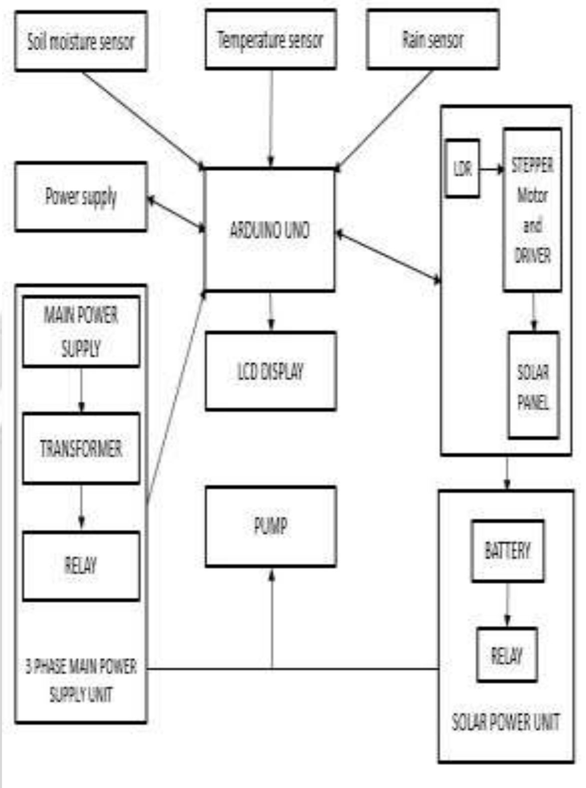

Figure 3.1 Architecture of smart irrigation system

In Figure 3.1, the main block diagram is shown. The end device node, coordination node, webserver node, and mobile device node are the four key components of the monitoring system (control unit). An Arduino controller, a GSM, a motor, a plant leaf image soil moisture sensor, a temperature sensor, and a humidity sensor are all components of the end device node. In the wireless sensor network, the microcontroller device is both utilised as the end device and a coordinating device. It is used in the network for data transmission. The serial RS232 data bus, which connects the web server system to the serial RS232 data bus-connected node coordinator, receives data that is continually gathered from the sensors and delivered to it. To monitor farming characteristics in real-time, data is collected on the web server. The data may be retrieved from the server and shown on the Android phone. The coordinator node receives the signal control automatically after that. Regardless of whether the motor is on or off, the end device always reacts in accordance with the signal it gets from the coordinator node. Using fuzzy logic, the motor for irrigation's on-off procedure is framed. Fuzzy rules are used to programme the controller. As a result, even with remote monitoring of the farm field, the system aids farmers in controlling the motor and water use in accordance with the needs of the farmland. Upon turning on, Arduino and GSM Modem/GPRS are initialised. Following initialization, the system prompts users to choose between manual and automatic mode. When automatic mode is chosen, the Arduino first determines whether solar power is available using the light-dependent resistor (LDR), which is used to determine whether sunlight is present. The solar panel is mounted on the stepper motor in this instance so that it can be exposed to light as the sun moves. The system is powered by a battery in the absence of solar energy. The system's water level sensor is used to display the amount of water in the tank in the farm field. The agricultural field begins to receive water through the relay after being connected to the pump, and the moisture sensor measures how dry the soil is. The crop field's soil moisture can be determined using the moisture sensor. The temperature sensor gauges the temperature of the surrounding agricultural field. The pump automatically stops pumping water into the field when it starts to rain in order to conserve electricity and updates the user's information via GSM/GPRS. To safeguard the crop damaged by the rain, the protective panels are automatically drawn. The alphanumeric display shows the sensor data that has been gathered. The suggested system's operating concept is shown in Figure 3.1, and its flowchart is shown in Figure 3.2.

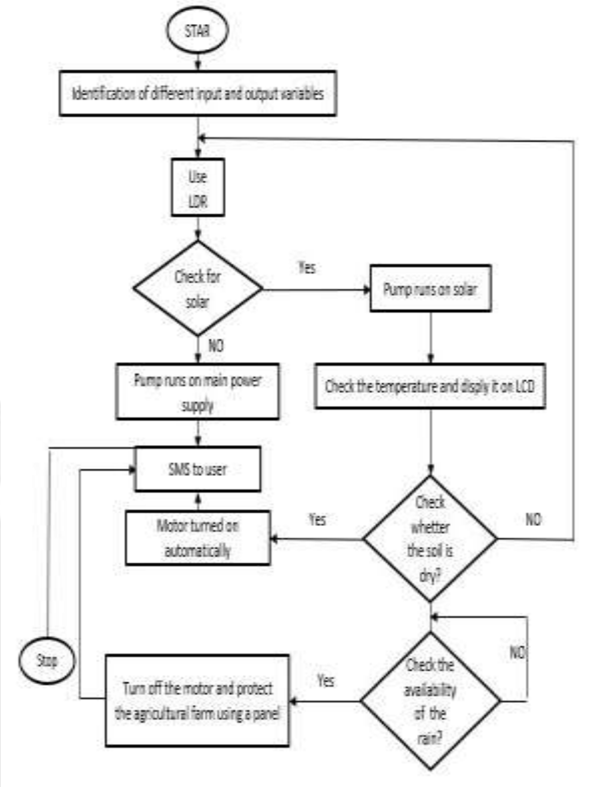

Figure 3.2 Diagram of smart irrigation system

- The moment the power source is switched on, the GSM modem is initialized.
- The GSM modem connects with Arduino via AT instructions.
- For accurate presentation of the data collected by the sensors, the LCD screen is connected to Arduino.
- The CPU first determines if solar energy is available by using a light-dependent resistor (LDR) to detect sunlight. The stepper motor is connected to the stepper motor driver, which is connected to the solar panel.
- When the sun's maximum intensity is reached, the solar panel spins both clockwise and anticlockwise, stops, and stores the energy in the battery.
- If solar energy is available, either solar energy or mains electricity is used to pump water to the agricultural area (3 phase lines).
- The soil moisture sensor measures the moisture content of the soil, which is kept between 500 and 850 (indicating dryness) at all times. The engine will pump water to the agricultural field when the soil moisture content is above 700.
- The farm's ambient temperature is measured by the temperature sensor.
- To save power, the rain sensor turns off the engine when it senses heavy rain. Also, panel is turned off to safeguard the crop.
- GSM technology will be used to transmit all data gathered from the sensors to the user.

B. Discussion

A mobile application-based smart irrigation system that enables farmers to irrigate their crops without consuming as much energy as conventional agricultural systems, which do. The system sends acknowledgement signals for task statuses such as soil moisture content, ambient temperature, and engine condition in relation to primary power sources or solar energy. The engine status outputs and input parameters (moisture, temperature, and humidity) are calculated using the fuzzy logic controller. When it rains, the system also turns off the motor to save electricity. The findings demonstrate that the suggested smart irrigation system achieves water and energy savings. Three primary capabilities are shown in the flowchart in Figure 3.2 and the schematic in Figure 3.1. They did not consider the security of the fields, which is why this prototype needs to be improved by including the functionality of field intrusion detection. The first functionality is the temperature check, the second functionality is the soil moisture check, and the third functionality is the rainfall availability check. When there is intrusion detection in the field, consumers will learn about it via GSM technology. This feature is utilised to detect intrusion and is measured using a passive infrared (PIR) sensor. The capabilities of intrusion detection will raise the bar of protection against unanticipated field infiltration.

IV. CONCLUSION

The examination of the various IoT areas (Smart Cities and Agriculture) was the primary emphasis of this work. We highlighted each IoT application's drawbacks and capabilities while also suggesting ways to make each one better. Furthermore, we have presented taxonomy for IoT enabled smart cities and farming based on the communication technologies, consumer electronics (CE), network types, offered services, mode of operation, and requirements that provide a clear understanding to the reader.

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