Agriculture Environment Monitoring System using Android Wi-Fi

Mr. Kalpataru B. Patil[1] Mr. Mahesh B. Girase[2] Mr. Vijay A. Mali[3] Mr. Sachin S. Koli[4] Prof. Jayvant R. Saindane[5]
[1,2,3,4]UG Scholar [5]Assistant Professor
[1,2,3,4,5]Department of Electrical Engineering
[1,2,3,4,5]D.N.Patel, COE, Shahada, India

Abstract— Agriculture has been the main occupation in our country for centuries. But now, due to the migration of people from rural to urban areas, there is an obstacle in agriculture. So, to overcome this problem, we look for intelligent farming techniques that use IoT. This project includes several functions, such as GPS-based remote monitoring, humidity and temperature detection, intruder intrusion, security and adequate irrigation facilities. It uses wireless sensor networks to continuously observe soil properties and environmental factors. Several sensor nodes are implemented in different locations in the farm. The control of these parameters is carried out via any remote device or Internet service and operations are performed via interface sensors, GSM, voice kit, etc. with a microcontroller. This concept is created as a product and is given to the well-being of the farmer. Advanced development in wireless sensor networks can be used to monitor various parameters in agriculture. Due to the uneven natural distribution of rainwater, it is very difficult for farmers to monitor and control the distribution of water in the farm field across the farm or according to crop needs. There is no ideal irrigation method for all climatic conditions, soil structure and crop variety. Farmers suffer big financial losses due to bad weather forecasts and wrong irrigation methods in this context, with the evolution of miniaturized sensors and wireless technologies, it is possible to remotely control parameters such as temperature, humidity and moisture. The main objective of this document is to develop an intelligent wireless sensor network (WSN) for an agricultural environment. Monitoring the agricultural environment by various factors such as temperature and humidity along with other factors can be significant. A traditional approach to measuring these factors in an agricultural environment has led people to measure manually and verify them at different times. This document investigates a remote monitoring system that uses the wireless network. These nodes send data wirelessly to a central server, which collects data, stores it and allows them to be analyzed, viewed as necessary and also sent to the customer's mobile phone.

Key words: Smart Agriculture, Android Wi-Fi, Soil Moisture Sensor, Humidity & Temperature Sensor, Fire Sensor

I. INTRODUCTION

A. *Introduction to Smart Agriculture*

As the world tends to new technologies and implementations, it is also a necessary goal to grow in agriculture. Much research is done in the field of agriculture. Most projects involve using the wireless sensor network to collect data from different sensors implemented in different nodes and send them via the wireless protocol. The collected data provide information on the various environmental factors. Monitoring environmental factors is not the complete solution for increasing crops. There are many other factors that reduce productivity to a greater extent. Therefore, automation must be implemented in agriculture to overcome these problems. So, to solve all these problems, it is necessary to develop an integrated system that deals with all the factors that influence productivity at every stage. But total automation in agriculture is not achieved due to various problems. Although implemented at the research level, farmers are not given as a product to benefit from the resources. Therefore, this document deals with the development of intelligent agriculture using the IoT and is given to farmers.

In the field of soil environmental monitoring, real-time monitoring of humidity and soil temperature can correctly guide agricultural production and improve crop yield. It can also provide a scientific basis for high-precision monitoring and drought calculation of farmland and floodplains. Traditional cable communication has many problems. It has wide prospects of application in the field of environmental monitoring of the soil.

II. LITERATURE SURVEY

The existing method and one of the oldest forms in agriculture is the manual method for verifying the parameters. In this method, the farmers themselves verify all the parameters and calculate the readings. It focuses on developing devices and tools to manage, display and alert users about the benefits of a wireless sensor network system. Its goal is to make intelligent agriculture using automation and IO technologies. The most important features are an intelligent robot with GPS-based remote control to perform tasks such as weeding, spraying, moisture detection, human detection and surveillance.

Cloud computing devices can create a complete computer system from sensors to instruments that observe data from images of agricultural fields and human actors in the field and accurately feed data into repositories along with location as GPS coordinates.

This idea proposes a new methodology for intelligent agriculture by connecting the intelligent sensing system and the intelligent irrigation system through wireless communication technology. It proposes an efficient and economical wireless sensor network technique to acquire soil moisture and temperature from various points on the farm and according to the need of the cultivation controller to decide whether irrigation is enabled or not.

It offers an idea on how the automatic irrigation system was developed to optimize the use of water for agricultural crops. In addition, a gateway unit manages sensor information. Weather conditions are controlled and controlled online using IEEE 802.3 Ethernet. The drying process of the partial root zone can be completely implemented. It is designed for the IoT-based monitoring system to analyze the growing environment and the method for improving decision-making efficiency by analyzing crop statistics. In this document, image processing is used as a tool to control disease in fruits during agriculture, from planting to harvesting. The variations are visible in color, structure and morphology. In this document, green houses are a building in which the plants are grown in a closed environment. It is used to maintain optimal environmental conditions, greenhouses management and data acquisition.

III. PROPOSED SYSTEM

In the field section, several sensors are distributed in the field as temperature sensor, humidity sensor and obstacle detection sensor. The data collected by these sensors are connected to the microcontroller. In the control section, the received data are checked with the threshold values. If the data exceeds the threshold value, the buzzer is activated. This alarm is sent as a message to the farmer and the energy is automatically disconnected after detection. The values are generated in the Android application and the grower gets the detailed description of the values.

In manual mode, the user must turn the microcontroller on and off by pressing the button in the developed Android application. This is done with the help of the GSM module. In automatic mode, the microcontroller switches on and off automatically if the value exceeds the threshold point. Shortly after starting the microcontroller, a warning must be automatically sent to the user. This is achieved by sending a message to the user via the GSM module. Other parameters such as temperature, humidity and PIR sensors show the threshold value and the water level sensor is only used to indicate the water level inside a tank or the water resource.

IV. SYSTEM DEVELOPMENT

A. *Block Diagram & Description*

The block diagram of the proposed work "Agriculture Environment Monitoring System" is as shown in the figure above. This system consists of various sensors for the monitoring the meteorological parameters. The system consists of a microcontroller, which is the main block of the system and acts as brain of the system.

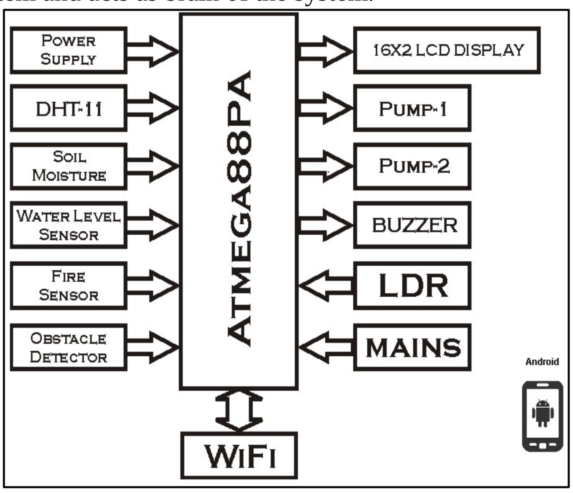

Fig. 1: Block Diagram of System Model

An ATMEGA88PA microcontroller is used and programmed to perform desired operation of the system. In this system a DHT11 sensor is interfaced with the microcontroller. This sensor is used to monitor the humidity and temperature of the farm field. This DHT11 Humidity & Temperature Sensor features a humidity & temperature sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.

The hardware of the system also consists of soil moisture sensors used to detect dampness content of the earth. A moisture sensor is used for sensing the soil condition to know whether the soil is wet or dry, and the input signals are then sent to the microcontroller, which controls the whole circuit. Whenever the soil condition is 'dry', the microcontroller sends commands to relay driver and water pumps gets switched ON and supplies water to the field. And, if the soil gets wet, the water pump gets switched OFF. In this system we have used two soil moisture sensors for two different parts of the farm field. Also we have designed the system in such a way that it can also monitor the humidity in the surrounding. This sensor measures Relative Humidity and Temperature and outputs in simple serial interface of two types. We have used a SY-HS-220 humidity sensor in this work.

In this system we have considered two water pumps for the water supply for the farm. To monitor the water level in the well we have used a water level sensor interfaced with the microcontroller. Two pumps are interfaced in the system, one pump is used to provide the water to the farm field from the well and other is used to supply water in the well from the river. These pumps are interfaced with the controller. The pump used to provide water to the farm field from the well is automated and will be controlled by the microcontroller signals. And other pump used to get water from the river is manually operated and can be turned ON and OFF by the farmer himself.

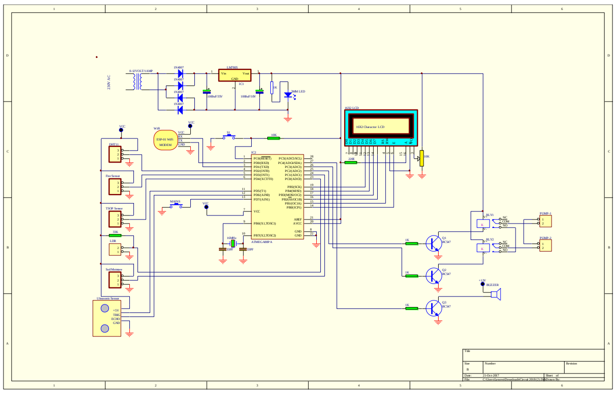

Fig. 2: Circuit Diagram

In this system we have used a fire sensor which is used to detect the fire in the farm field. This fire sensor is interfaced with the microcontroller and placed in the suitable place in the farm. This fire sensor sends signal to the controller as soon as it detects the fire due to any reason in the farm. Also an obstacle sensor is used and interfaced in the system as shown in the architecture of the system. This obstacle sensor is used to detect animals enters the farm and destroys the crops in the farm. To intimate the farmer about the fire and to run away the animal from the farm filed to protect the crops from destroying a Buzzer is interfaced in the system. This buzzer will be controlled by the microcontroller and will be turned ON and OFF as per the signals obtained from the sensor network. A LDR is interfaced in the system to turn ON the Lamp as natural light is vanished in the evening and night time. The architecture of the system consists of a mains monitoring block. This is used to continuously monitor the line supply that is whether the line supply is available or not.

All the monitored parameters and status of the water pump 1 and 2 will be displayed on a LCD display. This is a 16x2 LCD display interfaced with the microcontroller for the above mentioned function. This display will show the values of the temperature, soil moisture in field, water level in the well, status of the pumps and also the humidity monitored by the sensor network in the system. This display shows the status of all the devices activated by the system as per their operation. To operate the system by means of an android application, all the data from the system need to be gathered on the android device that a smart phone having android operating system. To obtain this data from the system we have interfaced a Wi-Fi module with the microcontroller. This module is used to transmit the readings of the sensors wirelessly to the Android device.

In controlling android device we have designed a program that is graphical user interface/application which contains indications for the water level, sensors data, lamp status, soil moisture, and temperature/humidity and for pump status. From this we can ON and OFF pump 1 as per the requirement of the field. All the parameters monitored by the sensor network of the system will also display on the same screen of the device.

V. WORKING OF THE SYSTEM

The system is designed to monitor the various parameters on which the production of the food material in the farm depends. This system consists of a network sensor to monitor surrounding environment and an automatic irrigation system to provide water to the plants. This system is designed in such a way that the user can operate it by means of a PC and can also monitor all the parameters from this PC. In this system we have developed a control window application in visual basic. Visual Basic (VB) is a programming environment from Microsoft in which a programmer uses a graphical user interface (GUI) to choose and modify preselected sections of code written in the BASIC programming language.

The circuit implemented in the farm field for the monitoring purpose consists of a DHT 11 temperature and humidity sensor. This sensor is used to measure the temperature and humidity in the surrounding environment of the farm field. This sensor is interfaced with the microcontroller used in the system. When MCU sends a start signal, DHT11 changes from the low-power-consumption mode to the running-mode, waiting for MCU completing the start signal. Once it is completed, DHT11 sends a response signal of 40-bit data that include the relative humidity and temperature information to MCU. Users can choose to collect (read) some data. Without the start signal from MCU, DHT11 will not give the response signal to MCU. Once data is collected, DHT11 will change to the low-power-consumption mode until it receives a start signal from MCU again. Microcontroller receives this data from the sensor and sends it to the controlling device wirelessly through Wi-Fi unit interfaced with the microcontroller.

The system consists of two soil moisture sensors used to detect the dampness of the soil in two different farm fields. These soil moistures are also interfaced with the microcontroller. The sensor would outputs logic HIGH/LOW when the moisture is higher/lower than the threshold set by the potentiometer and provides these signals to the microcontroller. Microcontroller then sends the data to the PC. The user then start the water pumps interfaced in the system to provide water to the farm field. Here in this work we have used two water pumps for two different farm fields. To operate the device from the android phone a Wi-Fi modem is also connected with the system, through which the user can send command to the microcontroller and turn ON / OFF the water pumps in the system. When it is observed that soil gets dry in field one and wet in field second, the user will turn ON the first water pump to provide water to the first field. To do this function the user will click on the "PUMP 1 ON" displayed on the window. When pump 1 gets started the system will initially checks the water level in the well from which water will be supplied. To check the water level in the well we have designed a circuit which includes a transistor. When there is sufficient amount of water is present in the well the transistor will be in ON state and provides the low signal to the microcontroller. Microcontroller then keeps water pump ON and if water is not available in the well the microcontroller will get high signal and immediately turns OFF the water pump. After checking the water level in the well the system will also checks whether the water is reached to the farm field or not. To do this function we have used flip sensors in the system. This function is used for a case of breakage in the water pipe. This flip sensor provides low signal to the microcontroller when water reaches to it which indicates that there is no breakage in the pipeline of the water and the water pump will be kept in ON condition for water supply. And if the microcontroller receives high signal from the flip sensor, which indicates that water is not reached to the sensor and there is breakage in the pipeline. At this condition the system will automatically turn OFF the water pump to keep it safe from damage. Same operation will be carried out in case of second water pump.

The system consists of a 16x2 LCD display which is used to display all the measured parameters by the system and status of the water pumps, water levels and flip sensors interfaced in the system. All the parameters monitored by the system will also be seen on the mobile screen that is an android phone. The mobile screen also contains indicating points for all the sensors, water level in the well and status of the water pumps. GREEN and RED indications are used for this purpose.

VI. HARDWARE COMPONENT DESCRIPTION

A. Atmega88pa Microcontroller

A Tmega88PA is a low power 8 bit AVR CMOS based on the improved RISC microcontroller. With the execution of powerful instructions in a single clock cycle, theATmega88PA reaches about 1 MIPS per MHz allowing the system designed to optimize the energy consumption according to the processing speed. The AVR core combines a rich set of learning records with 32 general-purpose jobs. All 32 registers are directly connected to the arithmetic logic unit (ALU), allowing two independent annotations to access a single instruction to execute in a cycle time.

The resulting architecture is more efficient code to achieve speeds up to ten times faster than conventional CISC microcontrollers.

ATmega48A / PA / 88A / PA / 168A / PA / 328 / P has the following features: 4K / 8Kbyte instantaneous programmable reading system with read 256/512/512 / 1Kbytes EEPROM, 512 / 1K / 1K / 2KbytesSRAM, 23 lines I / O for general use, 32 flexible multi-use sheets with three timers / counters with comparison means, internal and external disturbances, a programmable USE series, a 2-wire serial interface oriented (eight channels TQFP and QFN in / MLF) package, a programmable timer watchdog with internal oscillator and five modes of energy saving software options. stop mode stops the CPU allowing continued operation of SRAM, timers / counters, USE, 2-wire serial port interface and the SPI threaded system

Deactivation mode saves the contents of the register, but blocks the oscillator, deactivating all other functions of the chip until the next termination or when the hardware is restarted. In the power save mode, the asynchronous timer continues to operate, allowing the user to maintain a time base while the rest of the device is idle. Noise Reduction Mode The ADC stops CPUs and all I / O modules, asynchronous timers and ADCs, to minimize performance noise during ADC conversions. In standby mode, the crystal oscillator / resonator is operating while the rest of the device is sleeping. This allows a very fast launch combined with low power consumption.

B. DHT 11 Humidity & Temperature Sensor

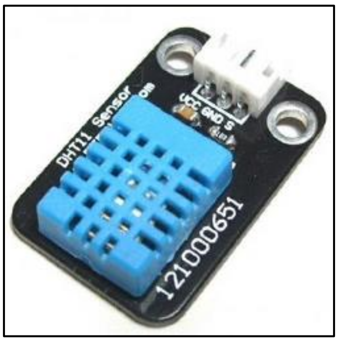

Fig. 3: DHT 11 Humidity & Temperature Sensor

This DHT11 temperature and humidity sensor is equipped with a complex temperature and humidity sensor with a calibrated digital signal output. Utilizing unique digital signal acquisition technology and temperature and humidity sensitivity technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive moisture measurement component and an NTC temperature component and is connected to an 8-bit high-performance microcontroller, which offers excellent quality, fast response, anti-interference and cost. effectively.

Each DHT11 element is rigorously calibrated in the laboratory that is extremely accurate in moisture calibration. The calibration coefficients are stored as programs in the OTP memory, which are used in the process of detecting the internal signal of the sensors. The serial interface of a single cable makes the system fast and easy to integrate. Its small size, low power consumption and signal transmission up to 20 meters make it the best choice for various applications, including the most demanding ones. The component is packaged with a single 4-pin strap. It is convenient to connect and special packages can be provided at the request of the user.

The DHT11 power supply is 3-5.5 V DC. When power is supplied to the sensor, do not send sensor cables within one second to become unstable. A 100 nF capacitor can be added between VDD and GND for power filtering.

C. Soil Moisture Sensor

Soil moisture measurement is important in agriculture to help farmers manage their irrigation systems more efficiently. Farmers not only typically use less water to grow crops, but can also increase crop yields and crop quality by better managing soil moisture during critical plant growth phases. In addition to agriculture, there are many other disciplines that use soil moisture sensors. Golf courses use sensors to increase the efficiency of their irrigation systems in order to avoid irrigation and drainage of chemical fertilizers and other external chemicals.

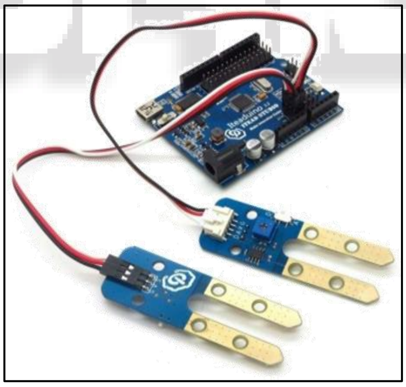

Fig. 4 Soil Moisture Sensors

Landscape irrigation, in urban and suburban areas, in residential landscapes and in lawns use soil moisture sensors to interact with an irrigation controller. The connection of a soil moisture sensor with one hour of irrigation will turn it into an intelligent irrigation controller that avoids an irrigation cycle when the soil is wet. In the farm automation system, the soil moisture sensor plays an important role.

D. Fire Sensor

The fire sensor, as the name suggests, is used as a simple and compact device for fire protection. The module uses an IR sensor and a comparator to detect fires at a distance of 1 meter. The device, which weighs about 5 grams, can be easily mounted on the body of the device. Provides high performance in the detection of fires. This output can be used to take the necessary actions. An LED on the board is also provided for visual indicators.

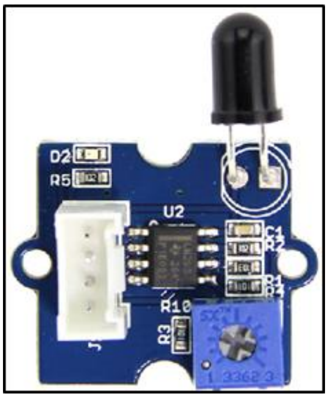

Fig. 5: Fire Sensor

E. Ultrasonic Sensor

Ultrasonic sensors (also known as transmitters when sending and receiving, but are generally called transducers) operate with a radar or similar sonar principle that evaluates the attributes of a target by interpreting radio or sound waves respectively. Ultrasonic sensors produce high-frequency sound waves and evaluate the echo received by the sensor. The sensors calculate the time interval between sending the signal and receiving the echo to determine the distance from an object.

This technology can be used to measure wind speed and direction (anemometer), tank or channel level and speed through air or water. To measure speed or direction, a device uses multiple detectors and calculates the speed from distances related to air or water particles. To measure the channel or channel level, the sensor measures the distance from the fluid surface. Other applications include: humidifiers, sonar, ultrasonic medical ultrasounds, burglar alarms and non-destructive tests. Usually the systems use a transducer that produces ultrasonic sound waves of more than 18,000 hertz, converting the electricity into sound, then, after receiving the echo, it converts the sound waves into electricity that can be measured and displayed.

Fig. 6: Ultrasonic Sensor

VII. ADVANTAGES DISADVANTAGES & APPLICATIONS

A. Advantages

1) Communication

Because the IoT has communication between devices in which physical devices can remain connected, maximum transparency is available with lower efficiency and higher quality.

2) Automation & control

Without human participation, machines automate and control a large amount of information, which leads to faster and timelier production.

3) Monitoring saves time & money

Because IOT uses smart sensors to monitor different aspects in our daily lives for different applications that save time and money.

4) Better Quality of life

IoT-based applications improve comfort and better management in our daily lives; improve the quality of life.

5) New Business Opportunities

Build new businesses for IoT technology, thereby increasing economic growth and new jobs.

6) Better Environment

It protects natural resources and trees and helps to create a greener and more sustainable planet.

B. Disadvantages

1) Compatible

Because devices from different manufacturers are interconnected in the IoT, there is currently no international compatibility standard for labeling and monitoring devices.

2) Complexity

IoT is a different and complex network. Any error or error in the software or hardware will have serious consequences. Even the power cut can cause many inconveniences.

3) Privacy / Security

IoT has the participation of multiple devices and technologies and many companies will monitor it. Because many data related to the context will be transmitted by intelligent sensors, there is a high risk of losing private data.

4) Less use of humble staff:

With the advent of technology, day-to-day activities are automated with less human intervention using IoT, which in turn reduces the demand for human resources. This causes unemployment problems in society.

5) Technology takes control of life

Our lives will be increasingly controlled by technology and will depend on it. The younger generation already depends on technology for every little thing. With IoT, this dependency will extend between generations and in the daily routines of users. We have to decide how much of our daily life we are willing to mechanize and control through technology.

C. Applications

1) In Farming Sector

Farm automation system is more useful for agriculture field. Even though farmer is at remote place, he can get the information with the help of such system as well as can monitor it. Farmer can get total information in farm surrounding like temperature, humidity, soil moisture.

In farm doing his work manually without using farm automation system, and in pic.2 farmers are using farm automation system so they do their work at home, no need to practically go in the farm. Therefore farmer can earn more in less hard work. It is money saving.

2) In Industry Where Liquid Flow Management & Distribution Is Required

This automation system not also useful in agriculture field but also useful in industry where liquid flow management and distribution is required.

3) Irrigation System Uses For Water Distribution

In irrigation system water distribution and management required. By using automation system we can easily distribute and manage water. For this required less man power and it is very fast. Calculation of water distribution made easy

VIII. Future Work

For future developments, it can be improved by developing this system for large tracts of land. The system can also be integrated to check soil quality and crop growth in any terrain. The sensors and the microcontroller are connected successfully and wireless communication is achieved between multiple nodes. All the observations and experimental tests show that this project is a complete solution for field activities and irrigation problems. Implementing such a system in the field can certainly help improve crops and overall production.

IX. Conclusions

In this document, a solution was presented to monitor the agricultural environments. The system can act as an early warning system for future threats, a monitoring system that constantly reports on the status of farms or livestock or as a recommendation system for potential farmers. It is stated that this system is relevant in the network society and that there is sufficient technical knowledge (software and hardware components, standardized network protocols) to make its implementation not only feasible but also profitable. These statements are corroborated by a review of existing monitoring technologies, including network protocols, open source software and low-cost hardware components used for implementation and a background study on the commercial value of such a system, a process Use the model of business of the frame on canvas to suggest valuable proposals.

A system prototype is presented, demonstrating its functionality to retrieve data from sensors, retransmit this data through a gateway and store and analyze data on a server. Subsequently, the results are presented to users through a web interface. The system features a customized sensor design for energy efficiency, data encryption for security, economy, economic components as well as ease of use and scalability. The business relevance established through the business model approach supported by stakeholder interview sessions, together with the technical maturity of a basic but scalable and robust technical implementation, provides the necessary impetus for future real development somewhere in the Agricultural Sweden.

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