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ARTICLE

MATHEMATICAL APPROACH TOWARDS RECENT INNOVATION IN COMPUTATION AND ENGINEERING SYSTEM (MATRICS)

SMART DRIP IRRIGATION AND REAL TIME MONITORING SYSTEM USING IOT AND DATA ENCRYPTION ALGORITHM

Antony Vigil, W. Abelwin Pereira*, Divya Jaikanth Naicker, J. Anto Levin

Department of Computer Science and Engineering, SRM Institute of Science and Technology, Chennai, Tamilnadu, INDIA

ABSTRACT

Irrigation systems are a significant factor with regards to modern cultivating techniques. This paper describes an implementation that embeds all the required technologies which are necessary for agriculture. Several parameters such as temperature, humidity, moisture associated with plants, these are measured with the help of sensors. Motion sensor is used to trigger the camera .i.e. it helps in switching the camera on/off and also gives the ability to record and capture images. This model helps us to predict the crop yields. The results are taken into account to switch the motor. We use hashing techniques to encrypt and secure the data collected from the sensors and transferred through Message Queueing Telemetry Transport (MQTT). The camera is operated via open CV, The data is stored in a cloud server and encrypted with advanced encryption standard (AES). This whole system is integrated together and the stored data is used for future analysis.

KEY WORDS
Internet of things, Sensors, Open CV, MQTT, Real time monitoring, Precision agriculture

INTRODUCTION

Irrigation is a very important factor when it comes to industrial farming. It helps in growing agricultural crops as well as in maintaining landscapes Water is a valuable common asset, however it covers ¾ of the earth its accessibility for human use is moderately less. Be that as it may, in contrast to power and fuel, the significance of water use and improvement in the worldwide perspective isn't that perceived [1]. Smart irrigation and other modern agricultural practices help in using the water resources in an efficient manner. Absence of motorization is viewed as one reason for the ruin of agribusiness fundamentally in India. Since the greater part of the farmlands being used are kept up by physical work of the ranchers and the labour that is as of now doing it is evaluated to diminish extraordinarily in the years to come.

IOT in straightforward terms is the aggregate system of interconnected gadgets which are implanted with or incorporate sensors, programming, organize network and fundamental hardware that help and empower them to gather and trade information making them responsive and brilliant in nature. It is one of the quickly developing fields and has been useful in conveying social and financial advantages for both the created just as creating economies [2]. The expansion in worldwide populace has brought about issues like constrained accessibility of land for agribusiness, increment in flighty climate conditions likewise constrained us to move towards savvy agrarian practices. Therefore, the utilization of IOT just as investigation of information are both utilized to upgrade the operational proficiency and produce in the farming sector [3].

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Precision agriculture is a mechanical move from the deep rooted cultivating methodologies which targets advancing the results by watching a horticultural framework via automatizing, estimating and reacting stages while keeping the general control of the framework effective as far as assets utilized or vital for agriculture. It for sure opens up a wide point of view for utilization of innovations that have been effectively utilized like remote detecting [4]. Real-time sensing systems is one of the major components that are needed for precision agriculture to be widely implemented and used [5].

Smart agriculture includes integration of IOT and sensor, wireless networks. The sensor technology here helps in recording the data from different places and parameters related to plants. The parameters include moisture of the soil, temperature etc. Soil moisture is measured with the help of moisture sensor [6]. Sensor node also helps in communication. The sensor technology coupled with internet of things gives a smart and varied approach to the nature of agriculture carried out, although there are instances when the interface is a bit slow and the implementation is a bit costly [7]. Real time monitoring is done with the help of camera [8]. Precision agriculture involves real time monitoring of the field and checking parameters like soil moisture, pH of the soil, humidity level and temperature level. It involves routing protocols, wireless sensor networks [9]. A system was designed to forecast and predict the crop yield and a possibility of an attack like pest attack and virus attack. Here the significant spotlight is on the most proficient method to improve the facility and continuous observing of the rural field. The crop simulation system only helps in studying the dependencies between the environment factors and the grain yield. The work is not enhanced to analysis end to end delay and end to end output [10].

***Corresponding Author**
Email: abelwin.w@gmail.com
Tel.: +91 9080905584

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MATERIALS AND METHODS

Proposed methodology

The proposed system here aims to do precision agriculture. We collect the required data from the different sensors which help in measuring different aspects associated with the plants. The collected data is stored and is mailed to the authorized personnel using MQTT [11]. The data is analyzed and the yield is predicted accordingly, also the stored data can be used in the future as a reference [12]. Smart irrigation helps in saving water. The setup is fully automatic in nature and also integrates all the systems making it one whole system hence making it smart in nature [13]. The complexity of the existing system has been reduced by replacing complex algorithms with simpler ones. The usage of sensors and camera for monitoring the parameters helps in making a smarter and an easy to understand setup. This not only enhances the age-old farming method but also paves a path towards smart irrigation as well as farming in a smarter and simpler manner [14]. Sensors have been employed to collect data. The sensors used here are temperature, humidity and moisture sensors. Temperature is estimated in Celsius and moistness and dampness is estimated in percentage. The gathered information is put away. The data from both the sensors as well as the camera is collected and stored. The data from the sensors is hashed using the hashing technique. The hashed data is thereafter sent via MQTT, That is the data is mailed to authorised personnel [15]. Camera is used with the help of open CV for the purpose of real time monitoring. The data collected through the camera is encrypted using the data encryption algorithm. The data collected is then understood, analysed and manipulated accordingly [16]. The analysis result is then used for precision agriculture. The data thereafter is mailed and stored in the cloud for future reference or analysis (refer [Fig. 1]).

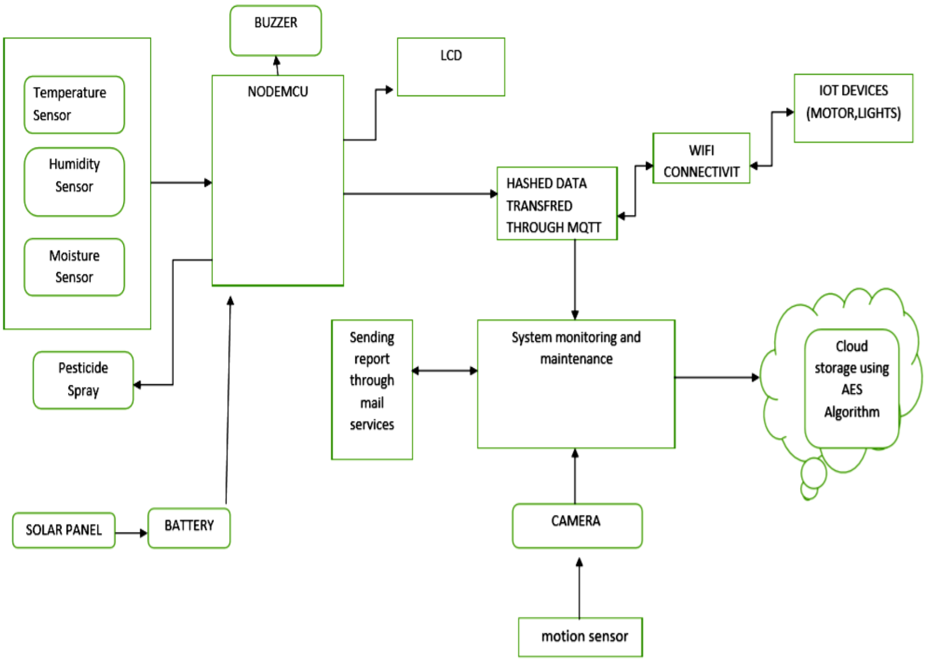

Fig. 1: overall architecture of system and design

Hardware requirements

a) Humidity sensor: This sensor is used here to monitor the humidity variation of the environment where the crops are cultivated. This is a digital sensor and measures the humidity value in percentage format.
b) Dampness sensor: The dampness sensor is utilized to gauge the water substance or dampness level in the dirt. At the point when the water levels in the dirt are low, the module yield is at elevated level, else the yield is at low level.
c) Temperature sensor: The temperature sensor measures the temperature of the environment based on the obtained value the controller controls the pump.
d) Motion sensor: This sensor is used to detect the presence of any motion i.e. to check whether any animals or humans are in the field and after that it triggers the camera. It has a 360-degree viewing angle [17].
e) Camera: High resolution camera with night vision is required for capturing images and recording the videos [18].
f) IOT devices such as smart motor pumps and smart lights. A buzzer is used to intimate about the water level or presence of any animals by producing sounds [19].

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Modules description

a) **Data Collection:** Data is collected from sensor which holds parameters such as humidity, temperature, moisture. The pictorial data is captured from high definition cameras. These data is used for various operations. The temperature sensor gives information about the temperature it is measured in degree Celsius or Fahrenheit. This gives us information about the temperature in the field. The humidity sensor gives the data in percentage which provides the information about the water vapour content present in the field; this estimates the amount of water to be sprinkled. The moisture sensor gives the data about the moisture content present in the soil, which helps in concluding the amount of water to be sprayed. Through open CV we are able to run the camera which helps us to monitor and obtain the pictorial data from the camera in the field all the time, here the camera is triggered with the help of motion sensor [20].

b) **Preprocessing**: The data from the Node MCU is hashed with simple hashing methods to provide a minimal level of security to the data. This data is further transferred through MQTT which help to control IOT devices such as motors and lights. There is an option to add more IOT devices for future purpose. Here the major emphasis is on precision agriculture and monitoring plant parameters with the help of sensors. The maintenance and operational computer are connected with the circuit to take control over the system which could be useful in case of emergency. The levels of water to be fed is decided and predicted by the data collected from the humidity and moisture sensors the reason to use humidity alone with moisture is to predict the weather and reduce the water usage. The data from camera is processed, the camera here runs on open CV. All the data collected from the sensors is transformed into a graph using an algorithm which runs on Mat lab and a report is generated and sent to the mail id provided. Only unauthorized-personnel can access the stored data hence ensuring data security. Adding a feature like buzzer to intimate the famer about the water level and LCD to check the working of the system (refer [Fig. 2]) [21].

c) **Data storage and analysis**: The processed pictorial data is further stored in cloud with which it is further stored in the cloud and secured by Advanced Encryption Standards (AES) but in this project we use only level 1 because in agriculture irrigation and monitoring is important than security and unwanted access is also restricted. Here we use asymmetric data encryption standards as it is more viable (data encryption). These data can be retrieved later for research purpose and analysis, the data from the sensor is stored in the mail with appropriate information or metadata [22].

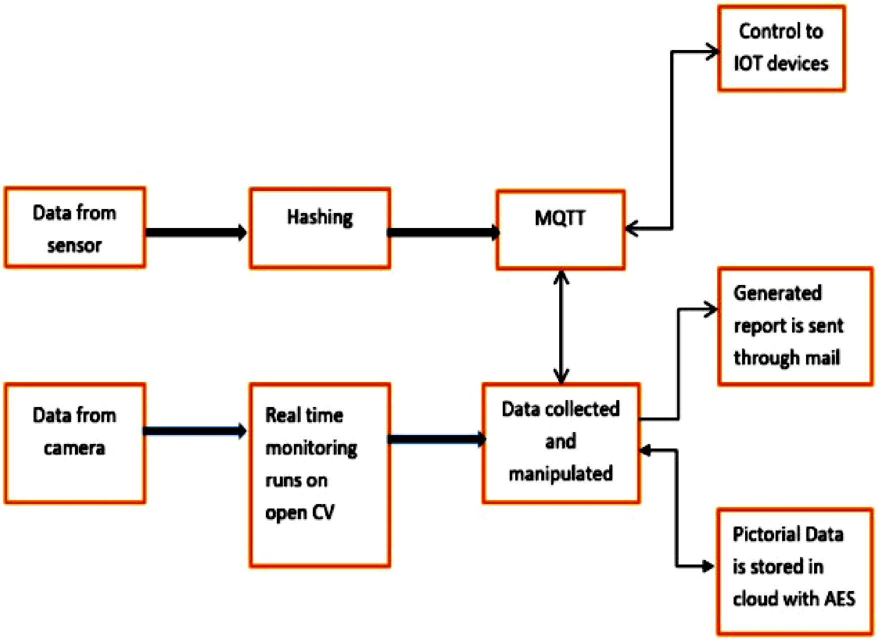

Fig. 2: data flow diagram

RESULTS

The graph in [Table 1] depicts the readings recorded by the three sensors namely humidity, temperature and moisture sensor. The graph is the result analysis of recordings recorded over the days. The x axis represents the time and the y axis represents the readings [Fig. 3]. The temperature is recorded in celsius. Dampness and moisture are represented in rate. The temperature was around 31 degrees it rose by 5 degrees and reached about 36 degrees on the mid time of the day. Humidity on the other hand decreased and reached to 34.48% as compared to beginning of the day. Moisture percentage differs by the amount of water fed into the fields and by the dew collected by the soil in the morning [23].

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Table 1: Sensor readings in tabular format

S.NO	TIME	Temperature (in degree celsius)	Humidity (in percentage %)	Moisture (in percentage%)
1	1:00am	27	56	50
2	5:00am	26	54	55
3	9:00am	29	46	45
4	1:00pm	32	50	35
5	5.00pm	29	52	60
6	9:00pm	28	54	55
	AVERAGE	28.5	52	50

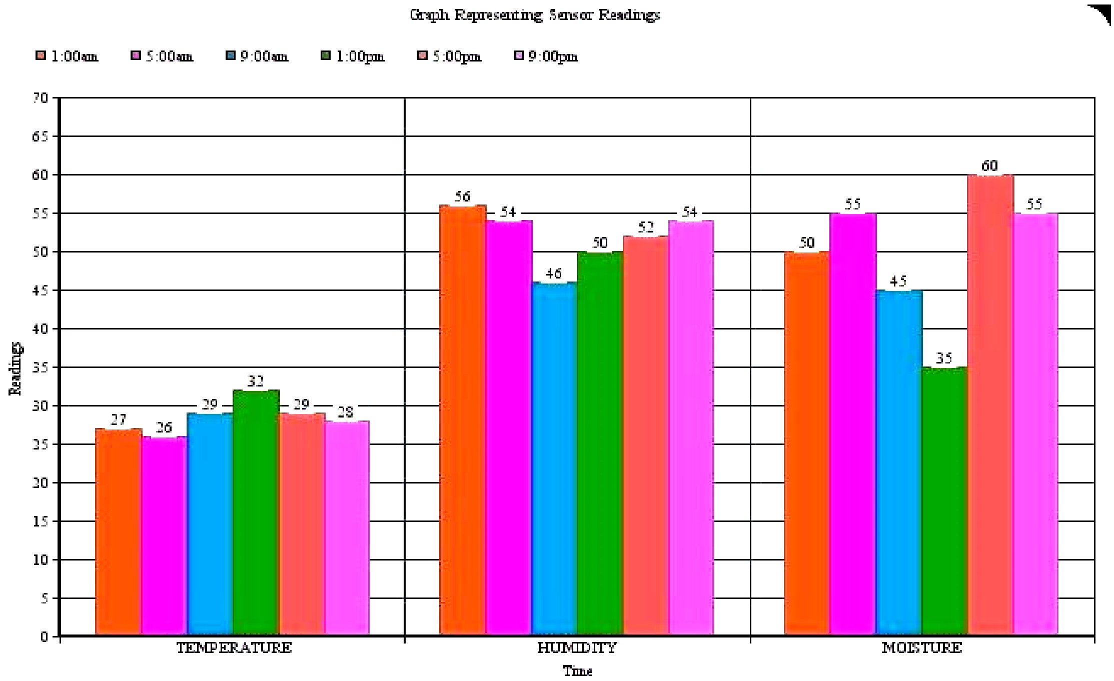

Fig. 3: Graph representing sensor readings

CONCLUSION

Developing an android application which in turn can be used for real time monitoring as well as for remote accessing and other uses. The android application can be designed in such a manner that the controls can be done from a faraway place like the house of the farmer. The monitoring system can also in turn be added for monitoring the plants in other fields. Advanced algorithms, like neural artificial intelligence algorithms can be implemented [24,25]. Hence forth, embracing computerization and more brilliant approaches to improve the manner in which we develop crops as well as harvests can keep the nation from confronting a dim time of emergency when the manual strategies will in general miss the mark out to nowhere. At this moment, if there should arise an occurrence of little and minimal homesteads, the squandered human work is extremely high and the yields are seen as low per capita work power. This makes the circumstance of the rancher right now more terrible than before since the cash produced using the effectively low yield is currently part to be given to the workers, henceforth, leaving nothing to the rancher. With keen and propelled strategies, for example, the model proposed here, the work power can be cut by an incredible sum without diminishing the yield, however expanding it enormously. This proposed model can be utilized for different purposes joined with the correct parts and coded with the necessary programming dependent on anything the rancher requires.

CONFLICT OF INTEREST

There is no conflict of interest.

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There are no financial conflicts of interest to disclose.

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