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Development of smart irrigation system for Agriculture Using IoT in Machine Learning.

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ABSTRACT: - *Scarcity of freshwater around the world is a very serious issue and there is dire need to come with a solution for the proper utilization of water resources. Smart irrigation technology uses weather data or moisture of soil data to determine the irrigation need of the landscape. The Internet of Things (IoT) and Machine Learning (ML) based smart irrigation system is employed in the field agriculture to overcome the problem of water resource management. Internet of Things (IoT) and sensors are technologies that further enable farmers to know the exact status of their field, including soil temperature, amount of water required, weather conditions and much more. In this work, a smart irrigation system is used to predict the irrigation requirements of the field using different environmental factors along with weather forecasting. This system is based on the technology of wireless sensor networks and its implementation requires three phases,*
(i) Data collection using sensors deployed inside the soil
(ii) Data cleaning and storage
(iii) Predictive processing
Keywords: *Smart irrigation, Internet of Things (IoT), Machine Learning, sensor*

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I. INTRODUCTION

Agriculture plays an important role in the economy and forms the basis of the economies of developing countries. Many people depend on agriculture for their income. A large part of these jobs come from the non-farm sector, which was created to absorb the rapidly growing population. Most of the developing countries depend on agriculture for their national income. For developing countries, it is the country that contributes the least to national income.

The main water sources for irrigation are underground wells, surface waters, reservoirs, storm water and city waters. Groundwater is found in the waters below the earth's surface. As rain occurs, some evaporates, some is carried by plants by evaporation, and the rest of the water comes from the topsoil and flows into sand, rock and stone.

The Internet of Things (IoT) describes a network of physical devices ("things") embedded with sensors. Software and other technologies used to connect and exchange information with other devices and systems on the Internet.

These devices range from home appliances to complex industrial devices, with more than 7 billion connected IoT devices today, and experts expect that number to grow to

billion by 2025. Agriculture is an important area of IoT. IoT systems play an important role in crop and soil monitoring and provide suitable solutions accordingly. IoT makes agriculture smart. By using IoT, farmers can reduce waste and increase productivity. The system provides monitoring of the fields with the help of sensors.

Farmers can monitor the condition of the field. Data from smart sensors can be further analyzed to make informed decisions and make predictions. Machine learning and forecasting will help farmers cope with extreme weather conditions such as flooding and flooding.

II. LITERATURE SURVEY

Traditional Agricultural Monitoring

In a number of the traditional irrigation machine, irrigation is scheduled via tracking the soil and water fame via using tension meter and drip irrigation by automating the controller gadget in sandy soil. In some irrigation device, fuzzy good judgment controller been applied for a green irrigation gadget for discipline having extraordinary vegetation. Fuzzy common sense increases the accuracy of measured cost and for that reason assists in decision making inexperienced house based cutting edge agriculture want to be exactly controlled in terms of moistness and temperature. The atmospheric conditions of flowers within the inexperienced residence vary from location to location which makes it difficult closer to preserving uniformity in any respect locations in farmhouse manually. So closer to this, GSM been used closer to reporting the reputation approximately irrigation for farmer's mobile handset

Intelligent IoT Based Irrigation System

The present Agricultural monitoring machine has employed wi-fi sensors for tracking the soil circumstance for irrigation also, a number of the gadget has employed cell handset additionally for transport. In none of these structures, there exists intelligence which analyses the actual time statistics based totally on beyond enjoy for irrigating the field. maximum of the machine simply captures the information from the field and thus controls the sprinkler valve for watering the field. In terms of device studying, lot of research been executed in the direction of crop yield and crop disorder prediction most effective.

There has been no studies pronounced which employs machine studying algorithm in the direction of analysing the soil condition based totally on skilled records set for irrigating the field robotically without any human intervention. also there exists no M2M machine which interacts among the machine in the direction of making evaluation and predicting intelligently. So, taking all of the above-mentioned drawbacks within the current machine, we here have developed an wise IoT primarily based automated irrigation device in which the temperature and moisture sensors deployed in discipline speak to Arduino microcontroller. The sensed moisture and temperature value is then transmitted the usage of serial communique to facet device called Raspberry Pi3. Raspberry Pi3 holds the system studying set of rules referred to as KNN (K Nearest Neighbour) category which takes the soil moisture and temperature into consideration. The KNN (K-Nearest Neighbour) set of rules classifies the gadgets based totally on closest training examples in feature area. this is a kind of instance based getting to know or lazy mastering in which the feature is approximated locally. Similarly, the computation is deferred until classification. this is the most essential and simples classification technique in which little or prior expertise approximately distribution of data is wanted. So closer to making an clever evaluation for irrigating the subject, exceptional soil situations i.e Dry, little Dry, little wet and moist are taken for education the facts set concerning soil moisture and temperature and hence predicting the soil primarily based on actual time records acquired for actuating the pump for watering the sphere. in the end the analysed facts along with subject irrigated are up to date in cloud server which we could the farmer realize the situation of soil and additionally water being irrigated. this can be accessed from farmer's cell. also graph information sheet of moisture as opposed to temperature and CSV record bearing on trained statistics set are saved in cloud server too. The whole gadget structure of our IoT based system is shown in figure. The device right here consists of three additives. First thing is the Arduino Microcontroller component where Soil Moisture and Temperature Sensor deployed in soil are linked to Microcontroller which offers the moisture and temperature output based on soil situation and Temperature. The information obtained via Arduino are then sent to part stage processor referred to as the Raspberry Pi3 using Serial communication that's second element. In Pi3, K-NN device learning set of rules been hired for predicting the soil condition based on Moisture and Temperature stage. The predicted output is then used for sending the manage sign through the serial conversation to Arduino for controlling water pump for watering the field for that reason. The final and final element is recording the soil moisture and Temperature stage and prediction with date and time within the cloud server for farmer's to get entry to from their cellular to have exact expertise and expertise on field being irrigated. The corresponding records flow Diagram, series diagram, Context diagram and Use case diagram bearing on IoT based machine are proven in below Figures. The flowchart of whole IoT based totally automatic Irrigation system is also shown.

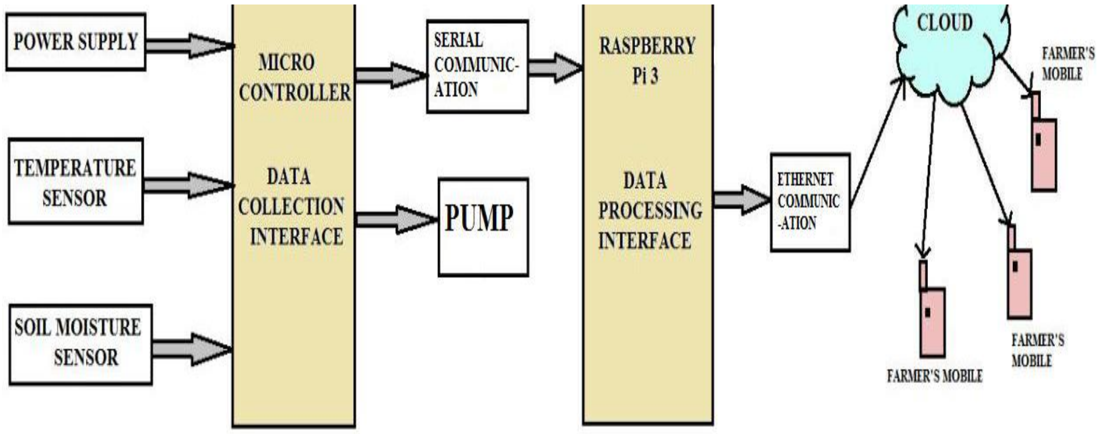
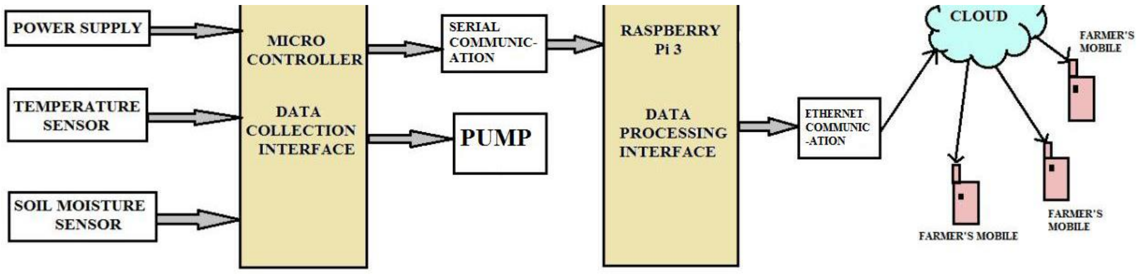
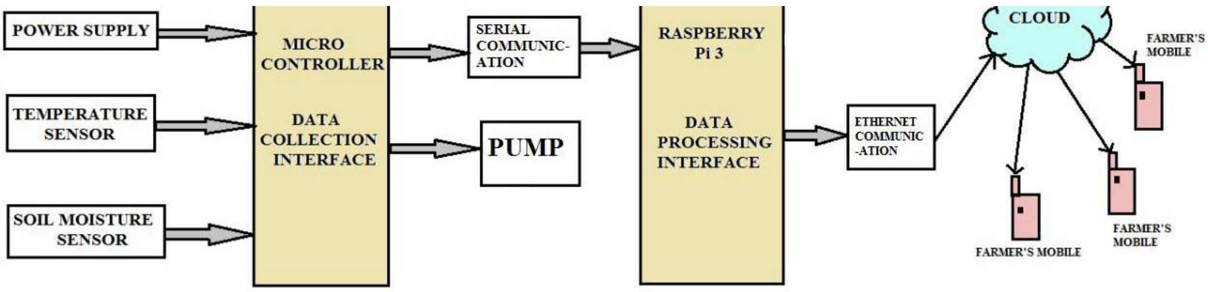


Fig.1 IoT Based Automated Irrigation System





III. REQUIREMENTS SPECIFICATION

2.1 Functional Requirements

1. Sensors for measuring soil moisture, temperature, humidity, and other relevant variables
2. Actuators for controlling the flow of water to the irrigation system
3. Machine learning algorithms to analyze the sensor data and optimize the irrigation schedule
4. User-friendly interface for configuring the system, monitoring sensor data, and adjusting irrigation schedules
5. Compatibility with different types of crops and soil types
6.Scalability to larger fields and farms

2.2 Non-Functional Requirements

In relations of non-functional requirements, we should be primarily focusing on the performance requirements of our system.

1: The model should be trained with a better accuracy dataset in order to categorize among the several emotions.
2: The quality of camera should be good so that it captures the video at a better quality.
3: The processor should be of i5 or more, else the video capturing will not happen.

IV. RESEARCH METHODOLOGY

The research problem is to develop a smart irrigation system that uses machine learning to optimize water use and increase crop yields. will conduct a literature review using academic journals, conference proceedings, and other relevant resources to identify existing research on smart irrigation systems, machine learning, and their intersections. A literature review will help identify research gaps and potential areas for research. Based on the research question and literature review, specific research questions and hypotheses will be formulated. For example: "Can a smart irrigation system using machine learning reduce water use while maintaining or increasing crop yields?""; "What is the best combination of sensors and machine learning algorithms to develop a smart irrigation system for a specific crop?" "The experimental setup will consist of developing a prototype smart irrigation system and testing it in a controlled environment such as a "greenhouse" or in the field. The experimental setup will include the selection of sensors, actuators and d machine learning algorithms to be used data will be collected from sensors that measure soil moisture, temperature and other related variables. Data collection will take place over a period of time to capture the timing of different weather and crop growth conditions.

The data collected will be analyzed using machine learning algorithms to develop predictive models and optimize irrigation schedules. Different machine learning algorithms will be tested and compared to determine the best for a specific culture and environment. Will use appropriate visualization and statistical analysis to interpret and present analytical results in a clear and concise manner.

The interpretation of the results will be based on the research questions and assumptions made in the steps above. Based on the results, conclusions will be drawn about the efficiency of smart irrigation systems and their potential for further development. Suggestions will be made to improve the system or apply it to other situations. The implications of research will be discussed in the context of sustainable agriculture, water conservation, and the potential of technologies to increase crop yields and mitigate the effects of climate change.

V. SYSTEM ANALYSIS

Activity diagram

Action diagrams show action to action. An activity diagram contains activity states and activity states, objects and transitions

- Activity diagrams are used to model the behavior of a system
- These users have human login/registration and image upload activity.
- System includes database collection activity, data enhancement preprocessing phase, extraction function
based on image size reduction.

Use case diagram

A use case is a description of how end users will use your code. Describes the task or set of tasks for the user to perform with the software and includes the software response to the user. A use case diagram is presented as a series of simple steps that begin with a user's goal and end when that goal is reached. · Administrators perform tasks related to management, event handling, and context-sensitive services, and data filtering is performed by temperature and soil moisture. The filtered data is stored online and sent to an event processing service accessible by the farmer. Use case diagram is represented as a sequence of simple steps, beginning with a user's goal and ending when that goal is fulfilled.

- Admin carry out the task which are facilated control , event processing services and context aware service ,data filtering is done by the temperature & soil moisture.
- Filterated data passed to event processing services which is stored in web which can be access by farmers.

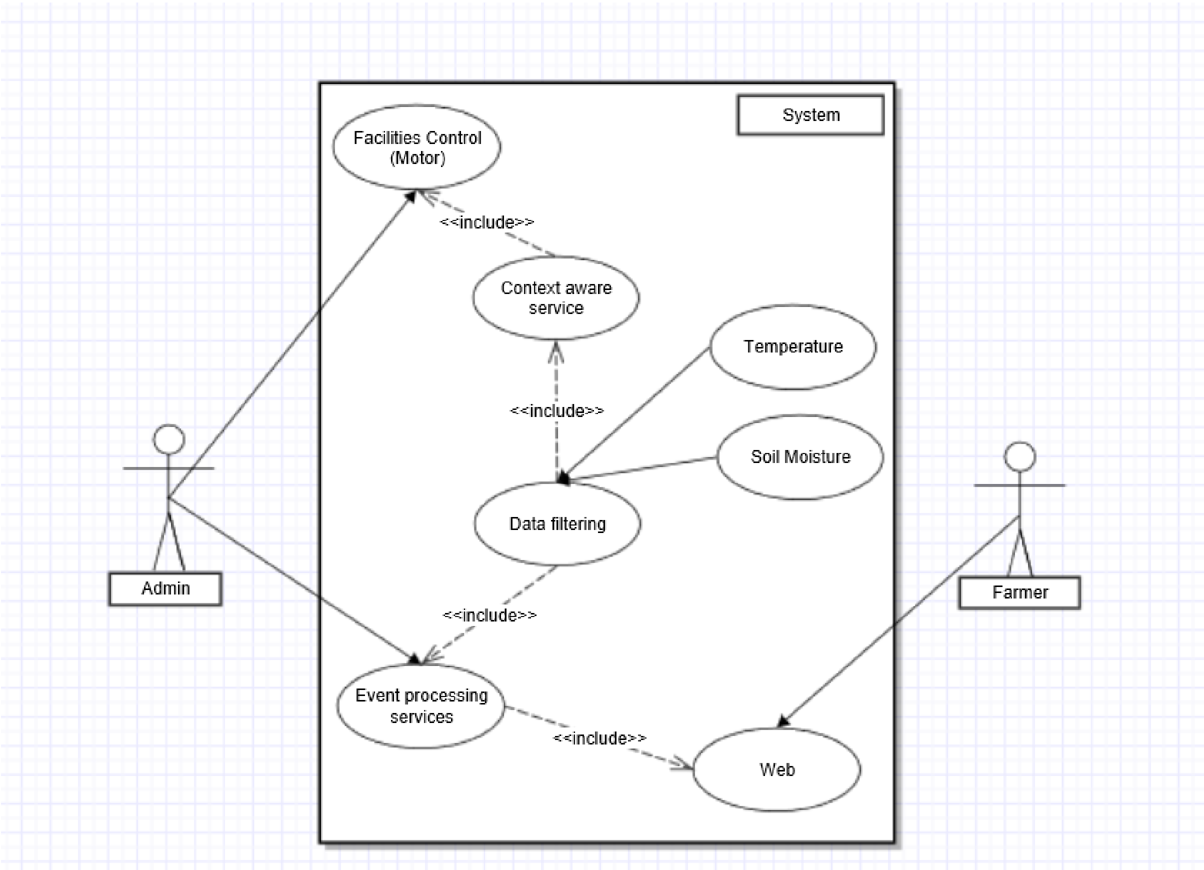


Fig. Use case diagram

Flowchart

In this section, we present an implementation of the new EDGE-Fog-IoT-Cloud architecture designed for smart agriculture and analyze the results obtained. A. Implementation and Analysis of Results The main goal of this experiment is to show how to create your own wireless network in the Arduino environment to transmit data from one or more sensors at any time of the days. We are developing an algorithm to predict soil moisture for the coming days with weather forecast information for years. The system was first tested in laboratory and is planned for testing at a vineyard near El Malach in western Algeria. Figure 3 shows a block diagram of the ML sub-process for running the model. An operational architecture (see in Figure 2) was developed to predict soil moisture based on field sensor data at the EDGE level. Weather forecast data using LSTM-based and GRU-based model.

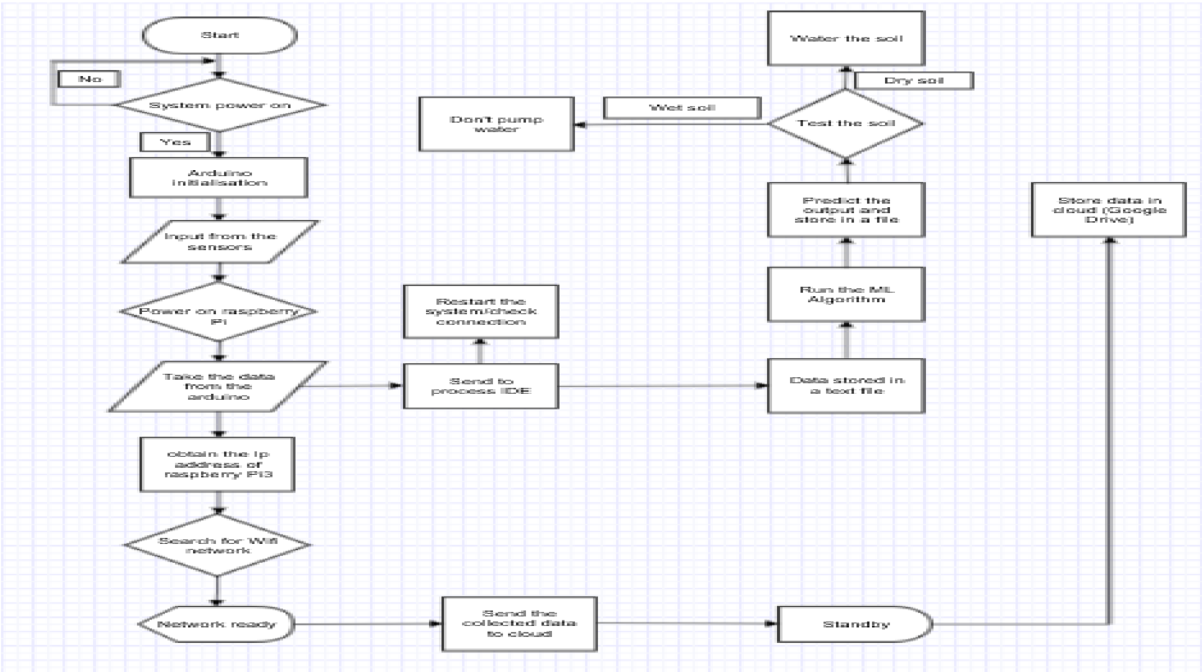


Figure: **Flowchart**

Data flow diagram

A data flow diagram shows this data flow in the system. DFD also provide output information. A data flow diagram can be expressed in ways. DFD stands for Structural Analytical Modeling Tool. Data flow diagrams are very popular because they help visualize the key steps and data involved in a process in a software system, as well as the inputs of each entity and the process itself.

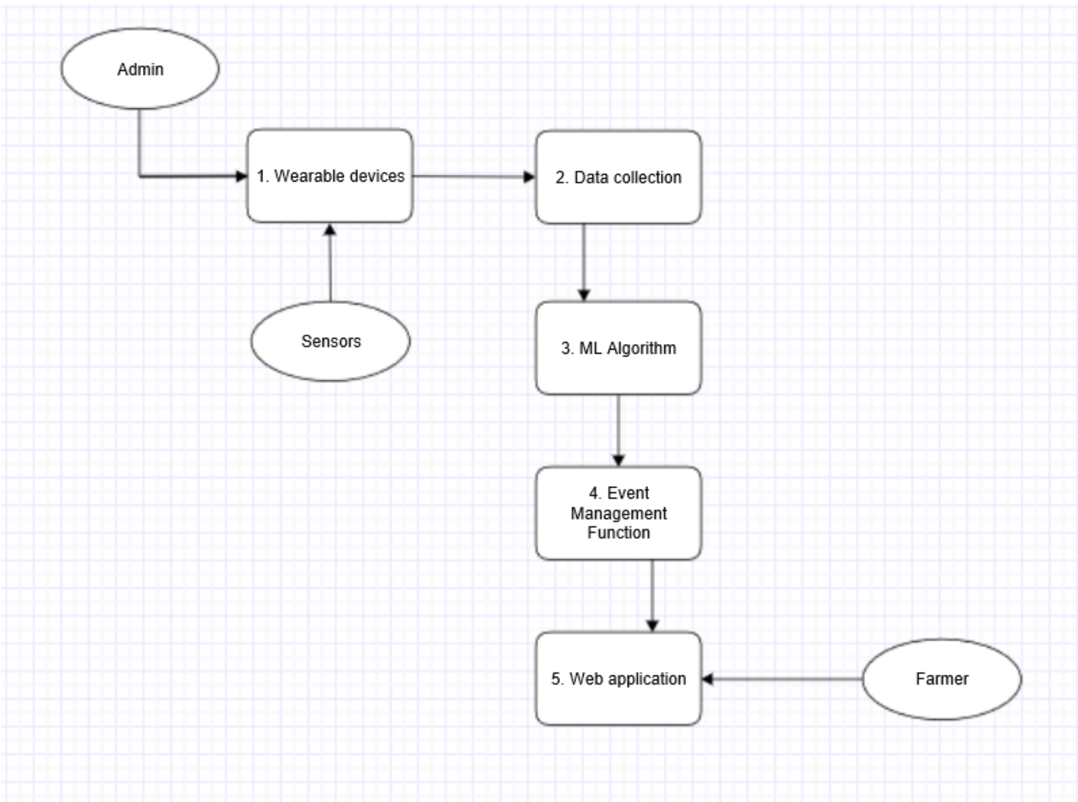


Fig. Data flow Diagram

Sequence diagram

A Unified Modeling Language (UML) sequence diagram is a type of interaction diagram that shows how and in what order processes interact. This is the construction of the message sequence diagram. Sequence diagrams are sometimes referred to as event diagrams, event scenarios, and timing diagrams.

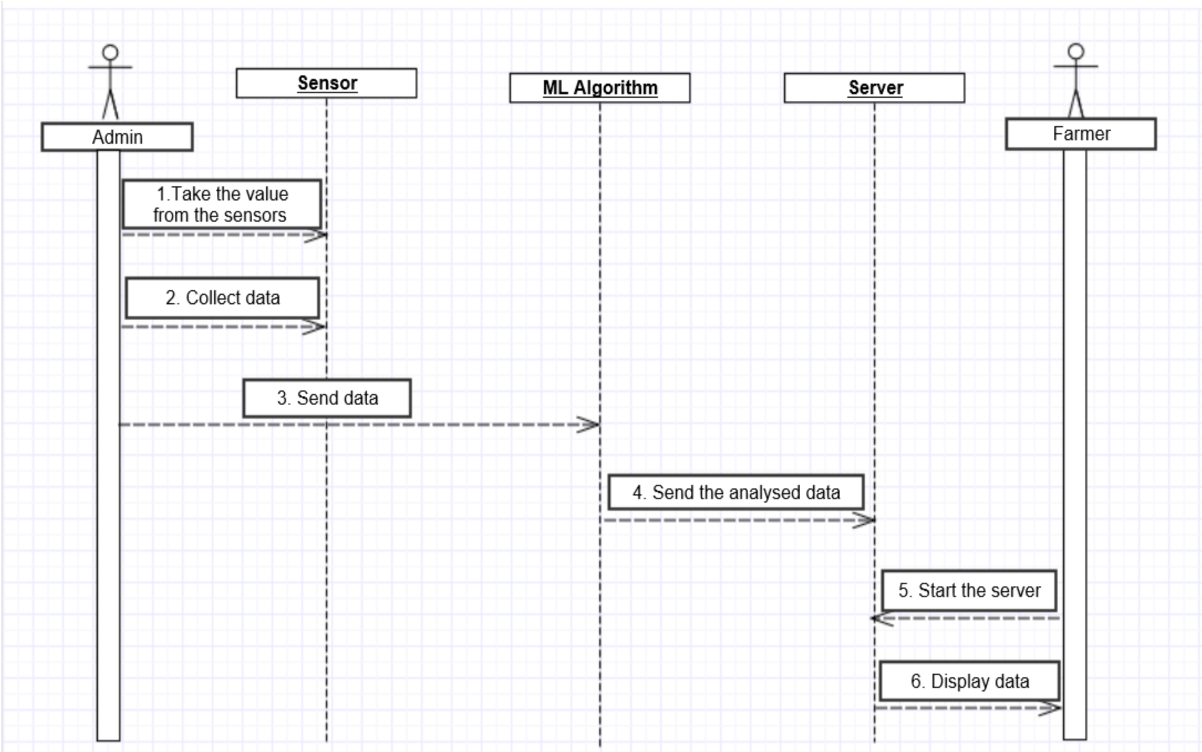


Fig. Sequence diagram

Context diagram

A context diagram shows that system as one high-level process, then shows the relationships that system has with other external entities (systems, organizational groups, external data stores, etc.. Another name for context diagram is context level data flow diagram or level 0 data flow diagram . Because context diagrams are a specialized version of data flow diagrams, it can be helpful to understand a bit about data flow diagrams

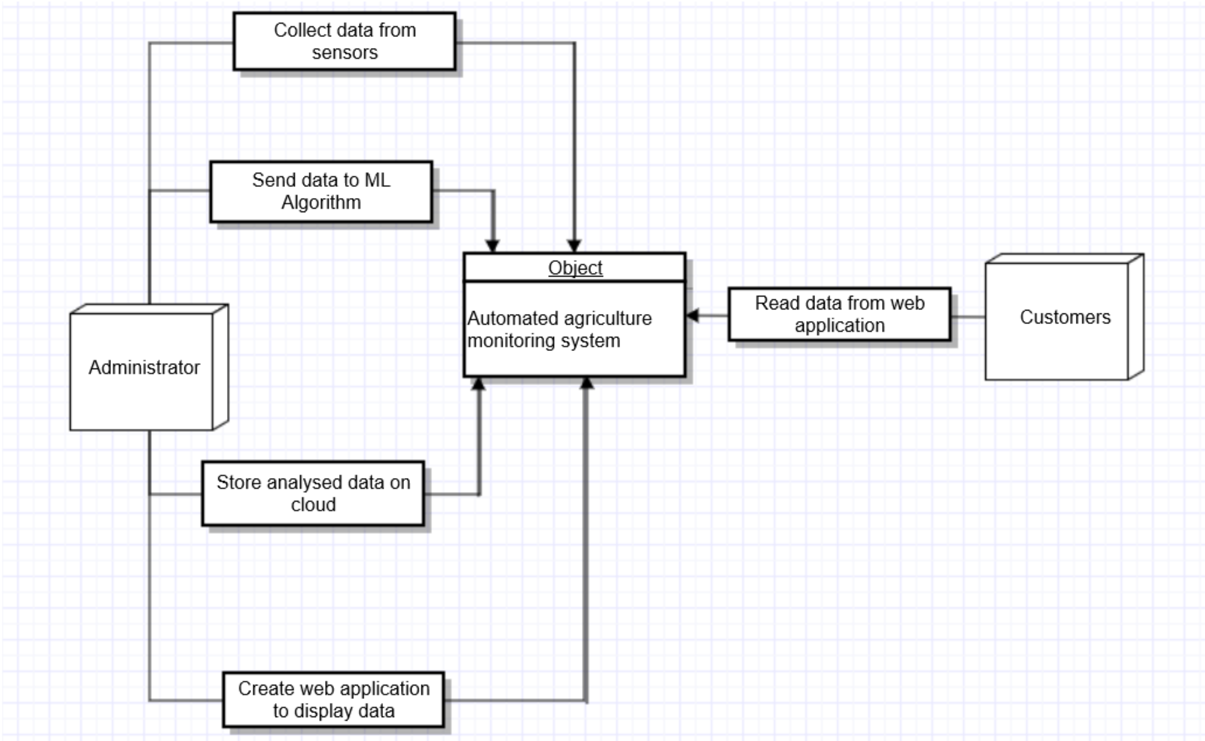


Fig. Context diagram

Conclusion:

Improved irrigation has been proposed to automate irrigation systems and the reduces water loss over large areas. The system mainly monitors the moisture behavior of the soil, air humidity and air temperature and determines how this contributes to the assessment of the plant's water requirements. The system uses machine learning to compare the actual values of the sensors with the test values passed to machine learning for analysis. Result determines whether to irrigate or not. The farmer receives a notification on his cell phone number,which allows him to choose whether to turn the water pump on or off. The system was calibrated to for rice crops. Since the future is to find alternatives to solve various problems, improving irrigation provides a way to achieve the desired results and a prediction for the future. Also in doing so, the documentation provides an opportunity to explore the fully automated and the control of the irrigation system in use, thus providing the ability to control the flow of the pump. Thus achieving advanced control capabilities.

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