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IOT BASED PADDY PROTECTION FROM RAIN FALL

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ABSTRACT: - Internet of Things is the use of new technology to increase the land productivity. One of the features of the internet of things is that it can determine temperature, soil quality (pH), rainfall, pests and humidity. The current problem is the difficulty of farmers in determining planting and pest control. In this study, an IoT will be designed to develop smart agriculture by using a system thinking to increase agricultural land productivity. The result of this research is a causal loop diagram of internet-based system thinking that can be used as a recommendation for increasing land productivity.

1. INTRODUCTION

Rice is the staple food ingredient of most Indonesians. The total population of Indonesia in 2019 reached 267 million people with an average rice consumption of 111.4 kg/capita/year. Where the increase in population has an impact on the need for rice. During a period of ten years (2009-2019) with an average consumption of rice per week of 1.64 kg [1] and an average population growth rate of 1.31 per cent per year. If Indonesia does not want to depend on rice imports, then Indonesian rice production must continue to be increased to keep up with existing population growth. Rice production in Indonesia has decreased by 5 million tons from the previous year [1], The issue of rice consumption and its fulfilment will remain an important agenda. The agricultural sector must continue to be developed.

so that it remains a mainstay in determining food security, increasing the income of farmers and rural residents, alleviating poverty, supplying quality labour for the non-agricultural sector, spurring economic growth and making the economy healthy [2] [3], Many challenges will be faced to increase rice production, such as land convection which has decreased every year, the level of soil fertility is decreasing over time, the lack of knowledge of farmers regarding agricultural technology, as well as irrigation and capital problems. In addition, climate change is a threat to the agricultural sector because it can cause crop failure, decrease productivity and production, damage agricultural land resources, increase the frequency, area, and weight/intensity of drought, increase in humidity; and increased intensity of plant pests (OPT) [4],

Precision agriculture is a technology-based approach to farm management that observes, measures and analyzes the needs of individual fields and crops. Smart fanning is defined as the application of information and data technology to optimize complex agricultural systems. Rice is smart farming because rice is an increasingly important staple food in the Asia Pacific region and other parts of the world.Changes in land use and soil salinity levels over time have a significant impact on rice yields [6], In addition, unpredictable weather conditions and inefficient techniques for predicting weather conditions are also among the factors that reduce rice yields [7] [8], For example, most farmers in Myanmar face heavy rains during the rice-growing season and crop damage and yield losses due to heavy rains cause widespread losses among farmers [9], As a result, the ability to predict whether or climate trends and environmental factors (eg soil nutrients) are very important in increasing the productivity of rice farmers [7], The current practice of relying heavily on fertilizers and pesticides to increase productivity does not support sustainable rice yield because this activity is not an environmentally friendly agricultural system [10], In addition, the timing of the rice harvest is also carried out affecting the production of rice yields as the best time to harvest rice shows a linear relationship with grain loss [11],

By considering some of the problems above, to meet food needs various efforts and strategies are needed for decision making. One of the ways that can be used to get the best decisions is a dynamic systems approach. A dynamic system framework can be used to analyze models and generate scenarios to improve system performance [5], Smart Agriculture includes agricultural practices by adopting IoT, sensors and others, to increase agricultural productivity. Smart Agriculture also addresses the interrelated challenges of food security and climate change and benefits smallholders by increasing the efficiency of inputs such as labour, seeds and fertilizers, increasing food security. Potential increases in farm profits can come from the adoption of new technologies, improvement and development of irrigation systems, and availability of fertilizers at affordable prices [12], Increasing productivity is the main key to increasing production. Increasing efficiency with more rational use of production inputs and good post-harvest handling is very important to increase production, reduce production costs, and ultimately increase farm income. So that in this research, a dynamic system model development research will be carried out which aims to increase the productivity of rice fanning in East Java, by maximizing the application IoT in planning rice planting schedules and management. Henceforth, the word Internet of Things will be discussed with the word IoT.

Research Design

1.1. Methods

The concept of Smart Agriculture is the use of various advanced technologies together with people's experiences and the results of past events to produce better problem solutions. Problems related to agriculture, namely irrigation, pest management, pest monitoring and plant monitoring [12], To solve this type of problem, system dynamics modelling is used because of its ability to handle problems well, then an approach emerges with the concept of dynamic systems, which allows an increased understanding of problems and behaviours that arise [13], The system dynamics simulation approach is considered suitable, because it is based on feedback in every part of the system that affects other parts [14],

1.2. Systems Thinking

System thinking has its roots in mental models and has been evolving and increasingly being used to understand Complex Dynamic Systems (CDS) since the 1960s [15], System thinking can be viewed as a language of communicating the various processes and interrelationship of a complex system in a nutshell to aid an effectivedecision-making process. The term system dynamics was first used by Jay Forrester in 1961 in his book industrial dynamics [16],

1.1. Role Of Smart Agriculture In Improving Land Productivity

The role of smart agriculture in increasing productivity of land used to increase the profitability, productivity and sustainability of this system, a paradigm shift is needed. To increase the productivity of land and air which decreases under suitable climate change, the conditions of tillage, which are recommended in the region, are manifested in the conditions of each crop. Resource conservation technology (RCT) cannot solve the productivity of land and air productivity, therefore an integrated approach to agronomy and soil manipulation depending on location, soil texture class, and agro-climatic conditions is a necessity at this time, but according to [17] adoption of resource conservation technology (RCT) in soil analysis dynamics during the intervention period and with reasonably good results which ultimately improves the livelihoods of poor South Asian farmers under the aegis of

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climate change scenarios.

1.3. System Thinking And System Dynamics

Systems thinking is a way of looking at something like a total, in which the parts are interconnected. It can even be called the conceptual foundation of the organization learners in increasing complexity. The dynamic complexity above, in systems thinking, can be elaborated in two ways views, namely: the complexity of detail and the complexity of dynamics [40], The complexity of detail can be interpreted as a collection of variables that are difficult to digest and control by thoughts as a whole. Because these variables are visible only as a collection of tables or a classification of variables. Meanwhile, what is called dynamic complexity is a description of a complex activity or event. Systems thinking has its roots in mental models and has grown and increasingly understood Complex Dynamic Systems [18], Therefore, from the dynamic system that exists in the journals under study, it gets inspiration from the complexity of science in addressing some of the problems and influences of existing public policies [19],

1.4. Internet Of Things

IoT are expected to have a large impact on Smart Farming and involve the whole supply chain, particularly for rice production. The increasing amount and variety of data captured and obtained by these emerging technologies in IoT offer the rice smart farming strategy new abilities to predict changes and identify opportunities. During implementation, various challenges were encountered, and here interoperability is a major hurdle at all layers in the Internet of Things System file architecture, which can be used with shared standards and protocols. Challenges such as affordability, device power consumption, network latency, Big Data analytics, data privacy and security, among others, have been identified by the articles reviewed and discussed in detail. A distinct solution to all of the challenges identified is to provide addressing technologies such as machine learning, middleware platforms, or intelligent data management.

1.2. Data Collection

At the data collection stage, this is done in several ways, such as: extracting information from various related sources such as articles or journals, previous research and data bank sites such as [1], and the mass media are ready to be contested for the development of rice plants at this time. Literature data are used as significant variables and additional variables that influence each other in the modeling of the system to be simulated. This study includes two types of data, namely primary data and secondary data. The raw data used as reference in this study include data on rice production (tonnes), rice yield (tons/ha), harvested area (ha) and East Java population (human). Primary data is used for system modeling purposes. Raw data is used as material for validation and comparison of real system models. Secondary data used in these studies include data on pests, weather and climate, data on rice prices at the producer level, data on demand for rice for industry and feed, data on consumption per capita, and other data related to food commodities (rice) and scientific research, previously related to the use of dynamic systems and improvement of production and application of environmentally friendly and drought-resistant rice technology. This data is used as material for modeling and reference research needs research.

1.3. Validation and Model Testing

There are two test methods to ensure that the model built represents the actual system. The first test is to verify the inventory structure and flow chart of the defined model. Structural testing is used to determine the credibility of the model built and executed by experts to assess the correct order and equation of the variables [41], Conducting structural tests to ensure that all variables are interrelated and nothing stops [39], In addition, structural testing should clarify the relationship between each variable in the form of feedback and the appropriate unit [41], The second test is the behavioral

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validity test, which is used in model verification to test the essence of the model according to the objectives the model wants to achieve. According to [39] the verification process is carried out by two test methods, namely model verification with a comparison test (mean comparison) or model verification with a comparison test of changes in amplitude (% error variance). The model is said to be valid if in the mean comparison test El 5% and in the amplitude variation comparison test (% error variance) if E2 30%

1.4. Structural Validation

Structural testing is done by checking for errors in the model that has been made. This is done to ensure that the formulation that has been made is in accordance with the relationship between variables and other variables and checks the units of variables in the model. If there are no errors in the model, then the model has been verified. When it is simulated, the model runs correctly and a notification "model is ok" appears, it can be stated that the model used in the study is correct. In addition, it is necessary to check the unit to find out all the variables in the model have the appropriate units.

1.5. Behavior Validity Test

The stock and flow diagram model that has been made will then be validated to test whether the model built is in accordance with the simulated real system [39], According to [39] the system validation process is carried out in two ways of testing, namely model validation with average comparison test statistics or mean comparison.

2. Result and Discussion

2.1. Boundary Adequacy

Table 1 is a table that describes internal factors and external factors, both supporting factors and factors that play a significant role in making a dynamic system model on the productivity and production of rice plants.

2.2. System Basic Pattern

In Fig. 1, The basic partem system assists in creating detailed sub-models in the causal diagram of rice production effect. In this case, there are 4 sub models that must be determined, namely: (1) the ratio of rice demand and fulfillment, (2) rice productivity, (3) harvested area, and (4) land productivity.

2.3. Rice demand and fulfilment Ratio Sub Model

2.4. Rice Productivity Sub Model

and land suitability greatly affect the yield of rice production. (2) The level of pest attack, where if the damage to ham is high enough, the level of harvest failure is also wide due to high crop failure, so the level of rice productivity will decrease. (3) The area of harvested land if the harvested area increases due to the release of existing land, the area of planting will also increase so that rice production also increases and vice versa if the harvested area decreases, rice production will also decrease.

2.5. Harvest Area Sub Model

Fig. 4 describes the general structure of the area of the rice field problem. Some factors influence the land release by the government (Bl) and land conversion (B2). These 2 main factors can influence the amount of rice production and productivity itself.

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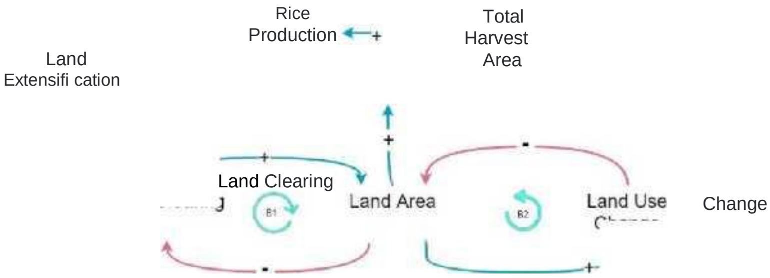
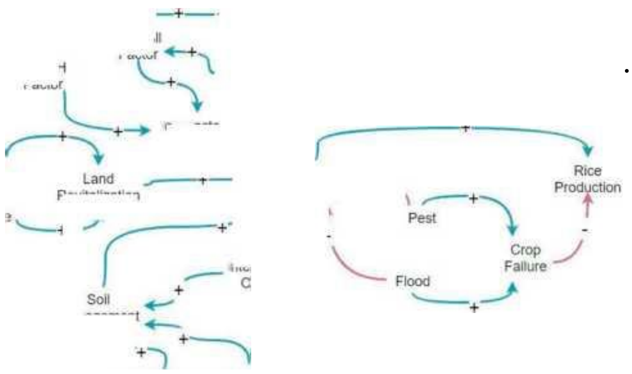
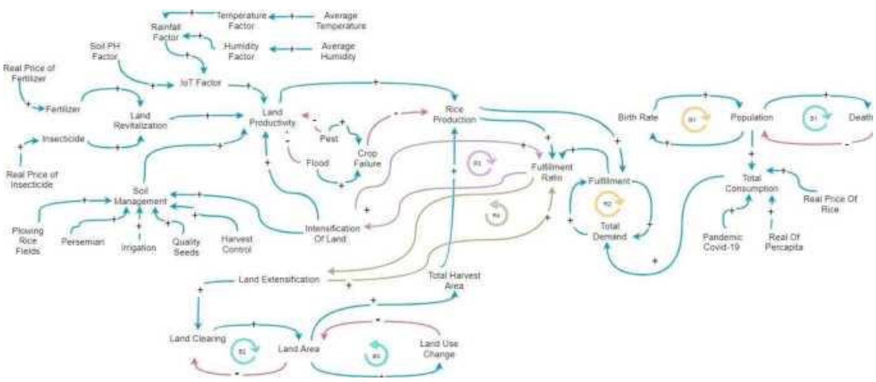


Fig.4 Harvest Area Sub Model





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2.6. Architectural Design Of The Internet Of Things

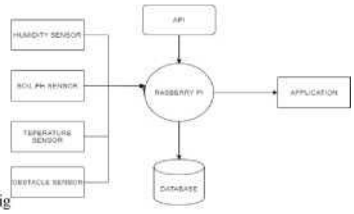

Fig 7 Architectural Design Of The Internet Of Things

Fig. 7 explains the performance process flow between each part of the IoT starting from the humidity sensor, soil ph sensor, temperature sensor obstacle sensor then the data goes to the raspberry pi device where the data is processed and stored in the database after that it can go to existing applications .

Conclusion

Based on the results of the analysis and discussion carried out, a conclusion appears in the form of several important information which raises between internal and external variables as well as supporting variables or factors that can increase rice production. Due to a causal relationship, this system is also influenced by several things such as what patterns emerge in terms of rice fanning and what are the things that might give success in the planting process and failures in the planting process. So a scenario model is made using the role of a dynamic system with the current rice farming conditions which can become a description of a new strategy for rice farmers. With the role of the Internet of Thing in the application of a dynamic system model, it is hoped that stakeholders and the government will be able to make the right decisions and predict unwanted possibilities in the future. Therefore, from the results of the resulting cause and effect, further research can be carried out on developing scenarios in accordance with existing problems in the future.

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