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AGRICULTURAL WASTE RECYCLE MANAGEMENT SYSTEM USING IoTs

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ABSTRACT:

Management practices should be automated since agriculture and poultry wastes are not being managed properly in Asian Countries .This helps to improve the cost effective and to reduce waste out of production. Hence we are proposing a framework that provides a system to monitor poultry, fish tank, and green house. IoT sensors are important along with raspberry pi in monitoring, controlling and reacting for environment. The dependency between environments can be found by proposed system. The main framework is to control the environment .And secondary aim is find waste dependency. And also to provide an extendable framework that can be utilized in any type of agriculture related environments.

Keywords: IoT, Poultry Automation, Fish Tank Automation, Poultry Waste Recycle

I.INTRODUCTION

The actions to manage the collection, transport, treatment and disposal of waste and monitor is termed as WASTE MANAGEMENT. In agriculture the wastes should be managed and handled properly to unlock the potential energy and to increase the profit. In different agriculture areas the dependency should be identified and the waste in those areas should be recycled among them to make profit out of waste. For example the poultry farms, fish farms and a vegetation farm have some dependency and the dependency of such farms are monitored and measured in a controlled environment in the research proposed. To study and analyze the maximum performance, this controlled environment framework can be extended to any agriculture farms and also to extend the season for farms and even in production for lowering the cost.

For many poultry management and fish tank automation the proposed Architecture provides a large portion and end-to-end waste management solution. This allows us to monitor and maintain the green farm, poultry and fish tank. This automation will measure the amount of waste and reduce the cost of management.

An Application Framework for IoTs enabled Smart Agriculture Waste Recycle Management System is proposed. The dependency between the smart farm, poultry and fish tank has been analyzed along with different monitoring sensors and actuators; and the usages.

A. Smart Farm

In the 21st century, SMART FARMING is important in the food sustainability. Soil moisture, air temperature, humidity and water level can be measured and monitored by using Atmel AVR microcontroller, sensors and

ZigBee network to grow plants using the current sensor and network stack. ZigBee protocol (IEEE 802.15.4) is useful in very low power consumption, message routing etc., To detect the disease and grade the vegetables and fruits, the artificial neural network is used.

Based on ZIGBEE technology, the wireless sensor and control nodes takes CC2530(true system on chip solution for IEEE 802.15.4) as core to control the environment data. This system is made up of front-end data gaining, data processing, data transmission and data reception. Open IoT platform can be used in Digital Agriculture. For storing the data streams from sensors in the field Phenonet domain can be represented using ONTOLOGY.

Fig.1. Smart Farm

B. Poultry Management

Poultry is the largest source for human food. Using Rasberry pi and Ardunio the Smart poultry management can be created. Using camera the behavior of poultry infected with avian influenza can be analysed by Modern poultry tracking system. The CO2, high temperature and high relative humidity and other harmful gases will be in birds farms. Monitoring of Weight, Environment, Soil features, Visual identification can be automated. For innovation in the egg manufacturing, the systems level technologies includes quality by design, technology transfer, cleanliness and yielding.

Near Infrared Spectroscopy is a good technique applied to quantitatively analyze many physicochemical characteristics, livestock , poultry manure and compost. A Low cost semi-automated vaccination machine consists of an injection, solenoid limit switch and connections. The projected production of the machine is 2000 chick/hour. Lighting in a poultry house is one of the important factors affecting fowls' health, growth, behavior, productivity and overall costs.

Biogas can be generated using the poultry waste. Poultry Biogas, produced in Anaerobic Digestion (AD)-plants, primarily consists of CH4 ,CO2 with smaller amount of H2S and NH3. For the electricity generation from biogas needs reduction of H2S(done by dosing air/oxygen to the main digester into the digestion process) because it forms a complex bond with iron. Poultry waste water can be used for irrigation after treatment.

Fig.2. Poultry Management

C. Fish Management

The worldwide best algorithm to search the application of behaviorism in artificial intelligence is ARTIFICIAL FISH-SWARM ALGORITHM. Using this fish can be feed efficiently Fish farm environmental data with immediate command and control over environmental data can be monitored using a mobile phone by AUTOMATED MONITORING SYSTEM. The ZigBee wireless sensor brings the data principal refine core. A WIFI interface shifts the data to consumer final device. The consumer can check the total fish farm environment through the final device.

The ozone technology fish storage system (OTFIS) is useful in the fishing boat, fish storage by means of transport for fish. The OTFIS yields a better result when we transport a fish from one place to another. The Automated Indoor Aquaponic Cultivation Technique was able to notice a good control performance.

Wastewater from aquiculture contains important nutrients for plant. The nutrients in wastewater from fish pond was absorbed and used by paddy field .From the fish waste Bio Oil can be obtained. Magnetic fishing technique, provides highly purified desired product. The cleaning waste of a fish is utilized by circulated energy system to produce a biodiesel. The biodiesel is used to produce the nearby required cooling and heating energy. And also, for the electricity network or local industrial use a power surplus is produced.

Fig.3. Fish Management

II. PROPOSED MODEL

Both study and analysis can be done by the controlled environment described in the proposed model which consists of a house of three layers. Green vegetation is done in top layer as it needs sunlight for harvesting. The poultry that can be fed by top layer is placed in second layer. The amount of feed supplied needs to be measured. The bottom layer is the fish tank where we can monitor and manage different variety of fish .One of the advantage is that fish can be feed by the waste from the poultry and that excess waste can be used to create compost for fertilization of top layer. Farmers will be benefited by this model as it suits for production in all types of farms.

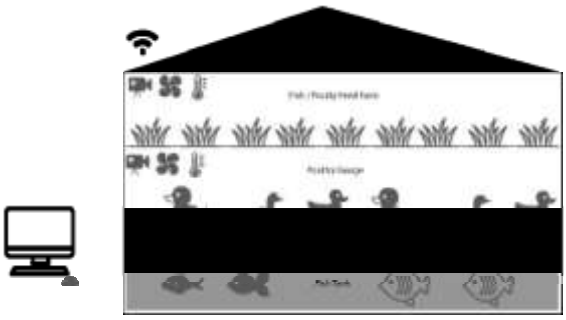

Fig.4. Proposed IoT enabled waste management model

A. Study Areas in agriculture using the model

Agriculture waste dependency can be studied using proposed model.

Few among them are

- Study of the different fish with the poultry waste as a feed
- Amount of poultry waste produced and the poultry growth
- Amount of eggs produced by the poultry
- Amount of crops produced by the top layer
- Amount of water contaminated by the poultry and fish
- Amount of white meat produced by the poultry
- Amount of fish produced
- Optimal environment gas, temperature and water purity
- Fertilizer used for the vegetation

B. Dependency Cycle

Dependency between the different layers of the model is shown below. Duck feed is provided by vegetation that can be used to feed the duck farm. The ducks can be fed by small fish and produces eggs and duck waste that can be the feed to the fish. They will clean the fish tank. The excess waste can be used to create the compost which to use in the vegetation layer. The eggs, white meat and the fish can be sold in market. We can use this model for different parameters like drakes etc.

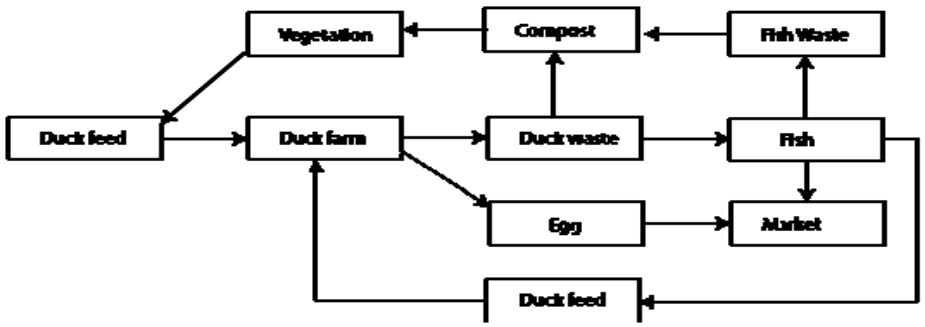

Fig.5. Dependency cycle between various actors in the model

C. Parameters for Sensor Network Monitoring

The below list provides the use of various sensors in the monitoring process.

- Birds monitoring (RFID (Radio-Frequency Identification), NFC(Near Field Communication), Motion, temperature, weight)
- Fish monitoring (motion, size, camera)
- Environment (temperature, humidity, air composition , airspeed, Air movement, light)
- Eating habits of poultry and fish (RGB (Colour camera) camera, accelerometer)
- Vegetation soil attributes monitor (Soil sensor, RGB camera)
- Vegetation fertilizer and compose doses monitoring (temperature, clock, humidity)
- Classification and separation of sick poultry, crops and fish using visual evidences (RGB camera)

D. Application Architecture

Wireless sensors, raspberry pi kit, Ardunio(open source hardware and software) and actuators(to receive control signal)are present. Via Ardunio, the sensor data of all layers in model are sent to raspberry pi kit. Sensor registry and its functions are maintained by sensor module. The functionality of various image based operations is provided by image analysis. This is useful to take decision about the management of the proposed model.

The poultry monitoring module look after the poultry like number of hens, ducklings, amount of food, waste and other productions etc., The compost monitor alerts when the compost is ready. The waste monitoring is taking care of waste produced in the process. The water, temperature and humidity are monitored by the sensors and look the target values set. Based on the video, weight and the motion pattern (accelerometer) the sick identification can be done for extendibility and critical alert, 3rd party API integration is enabled .The reporting is done using the tablet or computer which can connect to the raspberry pi which has my SQL as database via USB.

To connect all the sensors, Ardunio UNO (microcontroller board based on the ATmega328) is used. Raspberry pi takes high level decisions. To monitor the temperature, humidity, soil in all layers, LM335 temperature, HIH-4030 Humidity Sensor, soil moisture sensors are used respectively. The algorithm is set like when moisture level gone below 50% then the Plastic Water Solenoid Valve – 12V will be activated to provide water for

vegetation. Fan will be activated to cool when humidity level raises has been used to provide inputs to the raspberry pi inputs are provided by SEN11745 CMOS Camera Module .

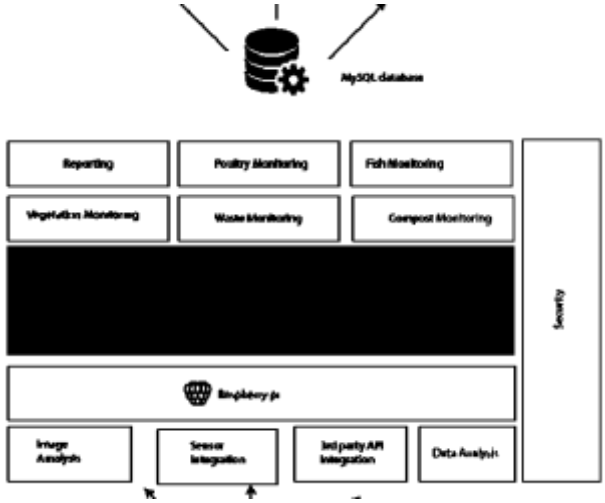

Fig.6. Application architecture for agriculture waste management

To drain the water and fill the water back to the tab, the Solenoid Valve is used. The data can be stored onboard by COM-11609 Micro SD Card that will hold the data for a while till data pushed into the connected PC. WiFi Module - ESP8266 is used to connect to the remote server to make the accurate decision, image analysis and dashboard and can store our data in to the remote server present in the My SQL. The data between the server and the raspberry pi My SQL can be synced directly using the My SQL commands. The Raspberry pi has built in web server and so we can see dashboard server. If proper routing is enabled in the home router, then we can access website around the world.

IV. CONCLUSION

The proposed framework is used to control and measure the various parameters in the vegetation, poultry and fish tank. This can be extended for season extending if we need to do in large scale. This model will reveal the dependency between the different areas. The implementation detail is the next goal of this research. Significant improvement in management of these areas can be done using this framework. The complete circuit diagrams and the design details will be presented in our future research.

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