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SMART AND SECURE GRANARY FARMER WAREHOUSE MANAGEMENT SYSTEM USING IOT

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A B S T R A C T

India is one amongst the biggest agricultural lands within the world with some 179.9 million hectares underneath cultivation. Still in Asian nation, food grains are keep at warehouse exploitation ancient technology that ends up in issues like thievery, rain, flood, variation in temperature and wetness, attacks of rodents, insects etc. A storage management system supported web of Things (IOT) has been projected during this paper work to handle the higher than problems associated with the storage of food grains. during this paper, sensible sensing devices are integrated with IOT and Wireless sensing element Networks to preserve the standard and amount of the keep product over time. this technique are often controlled and also the parameters are often monitored from remote location. The notifications are often delivered within the real time supported info analysis and process while not human intervention. The network of sensors includes PIR, humidity, temperature, fire ,gas sensors. supported the sensor's information the suitable information is captured and manipulated supported the limit given within the package and send timely info to the priority department officers of Central warehouse corporation through SMS for moderation and corrective actions arising because of region conditions within the warehouse. within the sub-Saharan region, an outsized quantity of the harvested grain is lost throughout storage. the lack to exactly monitor and management the inner conditions of a storage home is one amongst the key factors resulting in this loss. Timely, relevant and correct info relating to the inner standing of the storage helps in maintaining the standard of the grains yet as in storage loss reduction. This paper presents AN automation system for grain storage homes found within the Sub Saharan region. The automation system was engineered on the paradigm of the Wireless sensing element Network, wherever spatially distributed sensing element nodes seamlessly communicate with a UNIX based mostly Raspberry Pi pc. The communication between them is achieved through a light-weight and reliable machine-to-machine communication protocol.

Keywords*: IOT , Smartcare , Warehouse Management System , Raspberry Pi , Arduino Uno*

1. INTRODUCTION

Agriculture sector being the backbone of the Indian economy deserves food security. Today, food preservation is extremely necessary to meet the food provide chain required by the developing countries like Asian nation. there's an enormous would like for preservation, protection, storage, distribution and consumption of food at later stage. the most objective of this paper is to preserve the food grains from rodents invasive at warehouses and additionally threat to destruction of hold on crops, because of variation in temperature, excess wetness, fire, theft, rain, flood, etc. so hold on food grains is delivered as and once needed (real time).In this paper we tend to are desegregation net of Things with good sensors to enhance the potency of food preservation in warehouse. throughout storage, amount also as quality of food grains are going to be diminished because of insects, rodents and microorganisms. most species have remarkably high rates of multiplication and, inside one season, might destroy 10-15% of the grain and contaminate the remainder with undesirable odors and flavors. Insect pests additionally play a polar role in transportation of storage fungi. Over the past years, IOT and WSN technology are introduced in agriculture for rising the potency of food production and transportation, however these technologies don't seem to be nevertheless used for food security purpose hold on at warehouse. the many challenge facing the food security at warehouse is that the interaction between the safety devices and to produce them intelligence to regulate alternative electronic devices like cameras, repellers etc to boost the potency of food security at numerous warehouses. The paper is especially worked on the IoT (Internet of Things).Internet of Things is that the network of physical devices, vehicles, home appliances and alternative things embedded with physics, software, sensors, actuators and property that allows these objects to attach and exchange knowledge. every issue is unambiguously classifiable through its embedded ADP system however is ready to inter-operate inside the present net infrastructure. The IoT permits object to be perceived or controlled remotely across existing network infrastructure, making opportunities for a lot of direct integration of the physical world into computer-based systems and leading to improved potency, accuracy and economic profit additionally to scale back human intervention. once IoT is increased with sensors and actuators, the technology becomes associate instance of the a lot of general category of cyber-physical system, that additionally encompasses technologies like good grids, virtual power plants, good homes, intelligent transportations and good cities. These devices collect helpful knowledge with the assistance of varied existing technologies then autonomously flow the info between alternative devices. Movement of birds or alternative animals within the warehouse is monitored, whereas the door was closed. If any movement is detected sound was generated by

speakers to scare the birds. The person enters IN/OUT time & all the sensors level monitored within the remote location victimisation IoT module. Once the abnormal happens, the MCU gets the alarm signal directly to cloud . to scale back fireplace accident level in warehouse, we tend to ar victimisation fireplace sensing element, we tend to fix them on the door. This project can helps US to observe in real time temperature, Humidity, smoke and additionally permits the user to regulate the changes. we tend to are victimisation PIR motion sensing element to find the motion of the person/animal within the warehouse/room.

2. RELATED WORK

Kavya P et.al [1] have projected on agricultural land within the world with close to 179.9 million hectares underneath cultivation. Still in Asian nation, food grains are hold on at warehouse exploitation ancient technology that results in issues like thievery, rain, flood, variation in temperature and humidness, attacks of rodents, insects etc. good sensing devices are integrated with net of Things (IOT) and Wireless device Networks to preserve the standard and amount of the hold on merchandise over time. This device are often controlled and monitored from remote location and delivering real time notification supported info analysis and process while not human intervention. Nikkila et al.[2] have projected Farm management info systems (FMIS) that have steady inflated in their level of sophistication as they need enclosed new technologies with net property being the most recent addition. However, few FMIS have used the total capabilities of the web, and also the rising idea of preciseness agriculture has very little or no support within the current commercially offered FMIS. FMIS for preciseness agriculture have bound extra needs to ancient FMIS, that makes the implementation of those systems technically a lot of difficult in many aspects. Our analysis aimed to spot the necessities display by preciseness agriculture on FMIS so appraise a contemporary Web-based approach to the implementation of AN FMIS that consummated these extra requirements. D.Singh et.al.[3] delineated concerning the web Of Things, its application and services. net-of-Things (IoT) is that the convergence of Internet with RFID, device and good objects. IoT are often outlined as "things happiness to the Internet" to provide and access all of real-world info. Billions of devices are expected to be associated into the system which shall need Brobdingnagian distribution of networks likewise because the method of remodeling data into substantive inferences. This paper presents all a couple of novel design model for IoT with the assistance of linguistics Fusion Model (SFM). This design introduces the employment of good linguistics framework to encapsulate the processed info from device networks. This paper presents a discussion on net orienting applications, services, quality and challenges for net of things exploitation RFID, 6lowpan and device networks. leader Tubaishat et.al.[4] delineated concerning the advances in hardware and wireless network technologies have created affordable, low-power, multifunctional miniature device devices. These devices structure tons of or thousands of spontanepous little device nodes unfold across a region. These device nodes collaborate among themselves to ascertain a sensing network. A device network will give access to info anytime, anyplace by aggregation, processing, analyzing and scattering information. Thus, the network actively participates in making a wise surroundings. Tadele Tefer et.al.[5] they researched on ancient storage practices in developing countries cannot guarantee protection against major storage pests of staple food crops like maize, resulting in 20–30% grain losses, significantly because of post-harvest insect pests and grain pathogens. On observe of ancient storage, granger farmers find yourself commercialism their grain shortly once harvest, solely to shop for it back at an upscale value simply a number of months once harvest, falling during a position. The potential impact on financial condition reduction and bigger support security won't be completed, however, if farmers are unable to store grains and sell surplus production at engaging costs. so as to beat this drawback a metal silo was developed as a legitimate possibility and verified effective in protective hold on grains from attack by storage insect pests. A metal silo could be a cylindrical structure, created from a iron sheet and hermetically sealed, killing any insect pests which will be gift. the employment of metal silo, therefore, ought to be inspired so as to forestall storage losses and enhance food security in developing countries. Grant R. Singleton et.al.[6] analysised on the requirements of identification on specific priorities for analysis and extension for national agricultural research and extension systems (NARES) determined from consultations with collaborators in specific countries. The gnawing animal Ecology Work cluster of IRRI provides one necessary avenue to market analysis on gnawing animal pests within the region. However, stronger skilled input is needed. In summary, IRRI has the distinctive comparative advantage to produce the foci and regional linkages for analysis and coaching and also the continuity for effort the necessary drawback of gnawing animal impacts on rice production. the main outcomes from this analysis and extension effort would be important enhancements in agricultural production, in food security, and in each human and environmental health.

3. RASPBERRY PI MODEL

The Raspberry Pi, employed in this system is, Raspberry Pi four Model B. it's the subsequent specifications, Broadcom BCM2711, Quad-core Cortex-A72 (ARM v8) 64-bit SoC @ one.5GHz, 4GB LPDDR4-3200 SDRAM, 2.4 rate and 5.0 rate IEEE 802.11ac wireless, Bluetooth five.0, BLE, Gigabit local area network, 2 USB 3.0 ports; two USB 3.0 ports, customary forty pin GPIO header 2 × micro-HDMI ports, 2-lane MIPI DSI show port, 2-lane MIPI CSI camera port, 4-pole stereo audio and composite video port, Micro-SD card slot for loading software package and knowledge storage, 5V DC via USB-C connection, 5V DC via GPIO header. The high performance quad-core 64-bit ARM V8 processor, offers the device the facility to execute the specified tasks with none vital performance problems. This helps whereas serving associate degree interactive and dynamic web content, in process the info from the sensors and coordinative the WSN within the garner - at the same time. the quality 40-pin GPIO header offers the device the aptitude to directly connect with numerous peripheral devices. The Raspberry Pi operates at a spread of temperatures between zero - 500C that makes it ideal for its application within the sub-Saharan region. Raspberry pi was effectively employed by [7], [2]for home automation, Rajkumar and Prakash [3] use for mechanically observation the scholar attending, Yuvashree et al.[4], used for the automation the loom operation, Shilpashree et al. [5] ,used for image process and patriarch et al. [6] , used for observation infants. From the on top of studies, it's clear that Raspberry pi will with success be used for numerous varieties of automation comes. All the researches sited on top of had a useful construct a lot of or less just like United States and solely differed on the precise application. additionally to the current, Raspberry pi was elect for these comes because it was tiny in size, programmable, smart entertainer, supports totally different programming languages, ASCII text file, reliable, reasonable and energy-efficient.

4. ARDUINO UNO

The Arduino Uno may be a microcontroller board supported the ATmega328 (datasheet). it's fourteen digital input/output pins (of that half dozen is used as PWM outputs), half dozen analog inputs, a sixteen megacycle per second ceramic resonator, a USB affiliation, an influence jack, associate degree ICSP header, and a push button. It contains everything required to support the microcontroller; merely connect it to a laptop with a USB cable or power it with a AC-to-DC adapter or battery to urge started. The Uno differs from all preceding boards therein it doesn't use the FTDI USB-to-serial driver chip. Instead, it options the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial convertor. Revision two of the Uno board features a resistance actuation the 8U2 HWB line to ground, creating it easier to place into DFU mode Revision three of the board has the subsequent new features: one.0 pinout: additional SDA and SCL pins that area unit on the subject of the AREF pin and 2 alternative new pins placed on the subject of the RESET pin, the IOREF that permit the shields to adapt to the voltage provided from the board. In future, shields are compatible with each the board that uses the AVR, that operates with 5V and with the Arduino Due that operates with 4.3V. The other may be a not connected pin, that's reserved for future functions. Stronger RESET circuit. Atmega 16U2 replace the 8U2. "Uno" suggests that one in Italian and is called to mark the approaching unharness of Arduino 1.0. The Uno and version 2.0 are the reference versions of Arduino, moving forward. The Uno is that the latest in an exceedingly series of USB Arduino boards, and also the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

5. PROPOSED PROCESS AND IMPLEMENTATION

PIR sensing element is employed to sight the motion, hearth sensing element is employed to sight the hearth accidents, DHT22 is employed to live the temperature and wetness. The sensing element senses and sends the corresponding outcome to relay module through arduino. the info is distributed to raspberry pi and keep in cloud. Then the output of raspberry pi is distributed to user to understand the condition of the food grains and more the precautions square measure taken to safeguard the food grains. Thus, this paper prevents the wastage of food grains within the warehouse. The arduino collects the info from the sensors – DHT22, hearth sensing element, PIR. Temperature management is performed by arduino via actuators-fan and bulb. once temperature will increase fan turned on and once temperature decreases bulb is switched on. wetness management is performed by arduino via fan. Ardunio is interfaced to raspberry pi. Raspberry pi acts as a entry to web. Arduino sends knowledge to raspberry Pi, via Raspberry pi values of temperature and wetness square measure keep in cloud. Raspberry pi sends knowledge to the remote user or authority. Real time watching of the storehouse is feasible. every bundle of products that enters the warehouse carries a RFID tag and RFID reader reads the tag and sends the info to the microcontroller. Victimization this we are able to monitor the obtainable stocks within the warehouse through IOT.

Gas sensing element is employed to sight If any gas is made within the Warehouse. Temperature and flame sensing element is employed to sight any hearth accidents happens within the Warehouse, if hearth is detected then acoustic waves square measure generated to extinguish the hearth. wetness sensing element is employed to live the wetness round the surroundings within the warehouse and it's intimated through IOT. Movement of birds or different animals within the warehouse is monitored, whereas the door was closed. If any movement is detected sound was generated by speakers to scare the birds. when the prediction of fireplace or smoke, ought to put-off the hearth. For that here a replacement technology is employed. that's a Sonic asphyxiator Extinguish hearth by Sound Waves. Generally, hearth is destroyed with the assistance of water or carbonic acid gas. Extinction hearth through sound bass looks like crazy. As compared to the opposite compound of classic extinguishers, this invention offers the cleanest thanks to put-off flames. Once we have a tendency to predict the hearth or smoke by deep learning technique, we'll send a knowledge to the ARDUINO UNO micro-controller from the computer. With the micro-controller, a South Dakota card is connected and that is storing the sound files. A speaker and electronic equipment circuit is connected with micro-controller. Once the micro-controller receives the info for hearth detection from the computer, the controller can scan the sound files from South Dakota card and generate the high frequency sound waves to put-off the hearth.The reader generates a magnetic flux through its integrated antenna at one hundred twenty five kilocycle per second. Passive RFID transponders even have associate degree integrated antenna that's tuned to identical frequency. once they square measure inside vary of the reader unit they're ready to draw adequate power from the magnetic force field to power their own internal physical science. Once powered they're ready to modulate the incident magnetic flux that is detected by the reader. during this manner the Transponders square measure ready to transmit their knowledge to the reader.

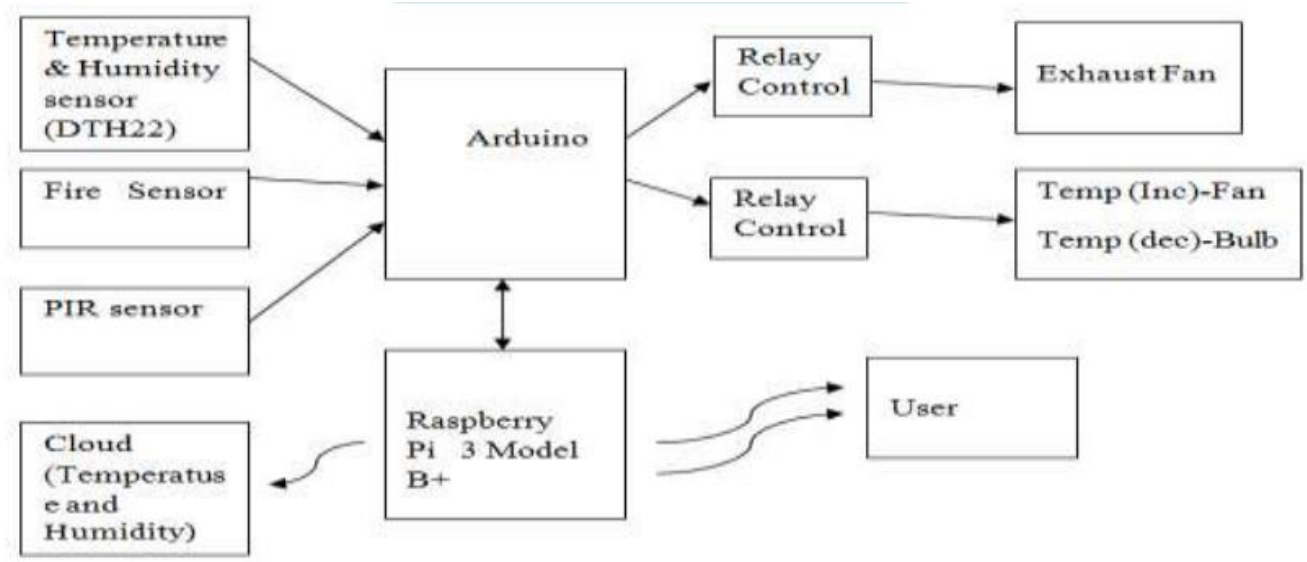

Fig.1.working and proposed architecture

6. SOFTWARE DESIGN

All of the computer code tools used for the event of this project square measure open supply and square measure freely out there. The computer code development method for this project was administrated with 2 separate approaches. they're the named as front and backside development processes. The front method concerned primarily with the event of user interfaces and human-machine communication means that. throughout backside method all the embedded parts were programmed and graduated consistent with standards developed for granaries. Arduno IDE is one amongst the foremost standard and freely out there tools for cryptography embedded systems. during this project, it had been used for programming all the device nodes within the WSN. Arduino may be a versatile C++ primarily based development atmosphere which might be wont to program differing kinds of microcontrollers. varied WSN primarily based comes have with success used this tool for programming the microcontroller [4] [5] [6]. A package, called Esp8266 core, was put in on the Arduino IDE to change it to access the NodeMCU. extra libraries, like the Adafruit DHT - device - library, square measure used for the correct operation of the sensors connected with the microcontroller. victimization the UNIX primarily based Raspbian software system on the most controller provides the Raspberry Pi with additional potency, speed, security and wide community support [7] [8]. Interaction among the embedded devices within the WSN is achieved through a light-weight application layer protocol called MQTT. it's a Publish-Subscribe protocol wherever the consumer subscribes to a selected topic and acquire updates whenever a brand new message is revealed. The usage of this protocol in environmental watching WSN has been evidenced to be economical through varied researches [9] . The publisher associated subscriber within the network communicate through an intermediator called Broker [2]. The broker elite for this project is Mosquitto - a light-weight broker appropriate for machine to machine communications additionally acts as a bridge for desegregation the WSN to the cloud if an online association is out there. The broker was deployed on the Raspberry Pi. In our model every device node publishes knowledge to the subscriber via Mosquitto. Thus, the subject Zone1/Climate is revealed by the DHT22 device, that is found in zone1, whereas Zone3/Motion is revealed by the motion device that is in zone3. With reference to this, the broker transfers these messages to a consumer that is signed to the topics. during this case the consumer may be a net server that uses the info to come up with charts and gauges on the net page. The consumer server additionally publishes messages with a selected topic. as an example, whenever the server publishes a message with the subject Alert/SMS, the Mosquitto broker directs the message to Zone3 as a node therein space is specifically signed to the present topic. Thus, supported the message received the node triggers the GSM module to send associate SMS message. associate interactive web content was developed for visualizing the environmental condition parameters and dominant some events within the storage house handily. during this method, associate interactive web content was designed and developed for visualizing environmental condition parameters and dominant some events within the storage house. the net application was programmed with a flow-based development tool called Node RED. it's associate open supply development atmosphere with comes promptly put in on the Raspbian software system. the event of event driven net applications through the utilization of Node-RED has been shown to be sturdy, quicker and easier to make . in an exceedingly UNIX atmosphere, the Node-RED is activated by writing the command sudo node-red-start, on the terminal of the Raspberry Pi [9]. the net application, developed by Node-RED, consists of gauges, a chart and a notification panel for displaying the incoming knowledge from the sensors. The lights on the storage house will be controlled through virtual button out there on the net page. It additionally consists of a computer menu that prompts the user to computer file like the variability of grain to be hold on and its harvest wetness price. supported the inputted knowledge, the system mechanically customizes its aeration rule to be appropriate for the hold on gain. the net application will be accessed through any commonplace browser. The science address used for accessing the net page from an area network is 192.168.43.163:1880/ui. A username associated password-based authentication portal was additionally organized - to forestall an unauthorized party from accessing the system.

7. CONCLUSION

This paper has incontestable the event of an automation system for granaries situated within the sub-Saharan region. The system was engineered by taking into thought of this environmental condition and socioeconomic conditions of the region. Thus, the choice of the hardware

and software system tools were created supported this notion. The developed system provides around the clock watching of the grain storage house whereas at an equivalent time generating live information updates on an internet page. the online application was designed to be simply accessible and secure. The aeration system was designed to effectively regulate the microclimatic state of the entrepot. moreover, the automation rule adjusts itself supported the input from the user through the online application. The automation method was tested with simulated triggers and satisfactory responses were ascertained. The projected system is ascendible and may simply be custom-made to be used in most grain storage facilities within the Sub Sharan region. and at last, further analysis, like the applying of machine learning algorithms within the existing framework, must be conducted to create the system smarter and absolutely autonomous.

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