CATTLE HEALTH MONITORING USING WIRELESS SENSOR NETWORKS

Project report submitted in partial fulfillment of the requirement for the degree of Bachelor of Technology

in

Computer Science and Engineering/Information Technology

By

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to

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Candidate's Declaration

We hereby declare that the work presented in this report entitled **" Darshita Peshwani"** "**Ayush Saraswat**" in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering** submitted in the department of Computer Science & Engineering and Information Technology**,** Jaypee University of Information Technology Waknaghat is an authentic record of my own work carried out over a period from August 2016 to December 2016 under the supervision of **Dr Yashwant Singh** (Associate Professor,Computer Science and Engineering). The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Darshita Peshwani, 131269
Ayush Saraswat,131281

This is to certify that the above statement made by the candidate is true to the best of my knowledge.

Dr Yashwant Singh
Associate Professor
Computer Science and Engineering

Dated:

ACKNOWLEDGEMENT

It is our proud privilege to epitomize my deepest sense of gratitude and indebtedness to our guide, Dr Yashwant Singh, for his valuable instructions, guidance and support throughout our project work. His inspiring assistance and affectionate care enabled us to complete our work smoothly and successfully. This report is a dedicated contribution towards that greater goal.

Date:
Darshita
Ayush

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LIST OF ABBREVIATIONS

Sr. No	Abbreviations	Term
1.	Wireless Sensor Networks	WSN
2.	Live Stock Management System	LMS
3.	Distributed Hash Table	DHT
4.	Electrocardiography	ECG

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Abstract

Cattle animal’s action can be recognized by periodic change in clustering degree and movement which might be imperative action parameter to reveal abnormal condition like anxiety, sickness and estrus. Any unusual action change is considered as an indication of ailment. In this report, we depict a financially savvy wireless sensor network technology for cattle health monitoring systems which recognizes any irregular behavioral change. At the point when elements in abnormal condition are recognized, the proposed framework creates caution alarms. Sensor network can accumulate ecological information like temperature, stickiness in animals cultivates, and the information is utilized as a part of controlling the electronic hardware. In light of such observing data, we can distinguish every animal's conduct and exercises effectively.

CHAPTER 1

INTRODUCTION

1.1 Introduction

The research of the project is to monitor the health parameters of the animal using a wireless sensor network. The sensor nodes contains in-network processing algorithm for the health monitoring and routing the respective data to the nearest base station. These systems will enhance the ability of the livestock units to react and to predict disease onset for epidemiological spread. Generally, cattle wellbeing has been determined by outwardly evaluating creature conduct or by manual examinations from a rancher or veterinarian This is time-escalated and can reasonably not be performed regularly. In this project, periodically the animal data is communicated to the base station, the offline processor with inbuilt code can detect the irregularities in the data. Animal status could then be easily generated as individual states of health, such as well, suspect and abnormal. The generated data could be sent to regional and national centers that screen the health of livestock animals, giving information to spot bigger patterns and bolster epidemiological research. This data, working together with past pattern information, can then be utilized to create a local health weather forecast that can tell veterinarians, farmers and crisis responders that cattle wellbeing concerns.. Sensor nodes collect various health parameters (e.g., temperature, heart rate, etc.), and wirelessly transmit them to other nodes and finally to the super node which communicates with the base station and processes the result.

1.2 Problem Statement

With the burgeoning scale of cattle farming, the livestock industries find it difficult to monitor the health status of each and every animal in the cattle farms on a daily basis and react against any abnormalities at earliest. To improve the functioning of a cattle farm and provide a comprehensive measure to check the animal's health condition poses the objective of our research.

1.3 Objectives

1. To study cattle health and various factors affecting it.

2. To study Wireless Sensor Network and its application in cattle monitoring system.
3. To propose a new model for cattle health monitoring in grazing fields.
4. To validate the proposed model by simulating data.

1.4 Methodology

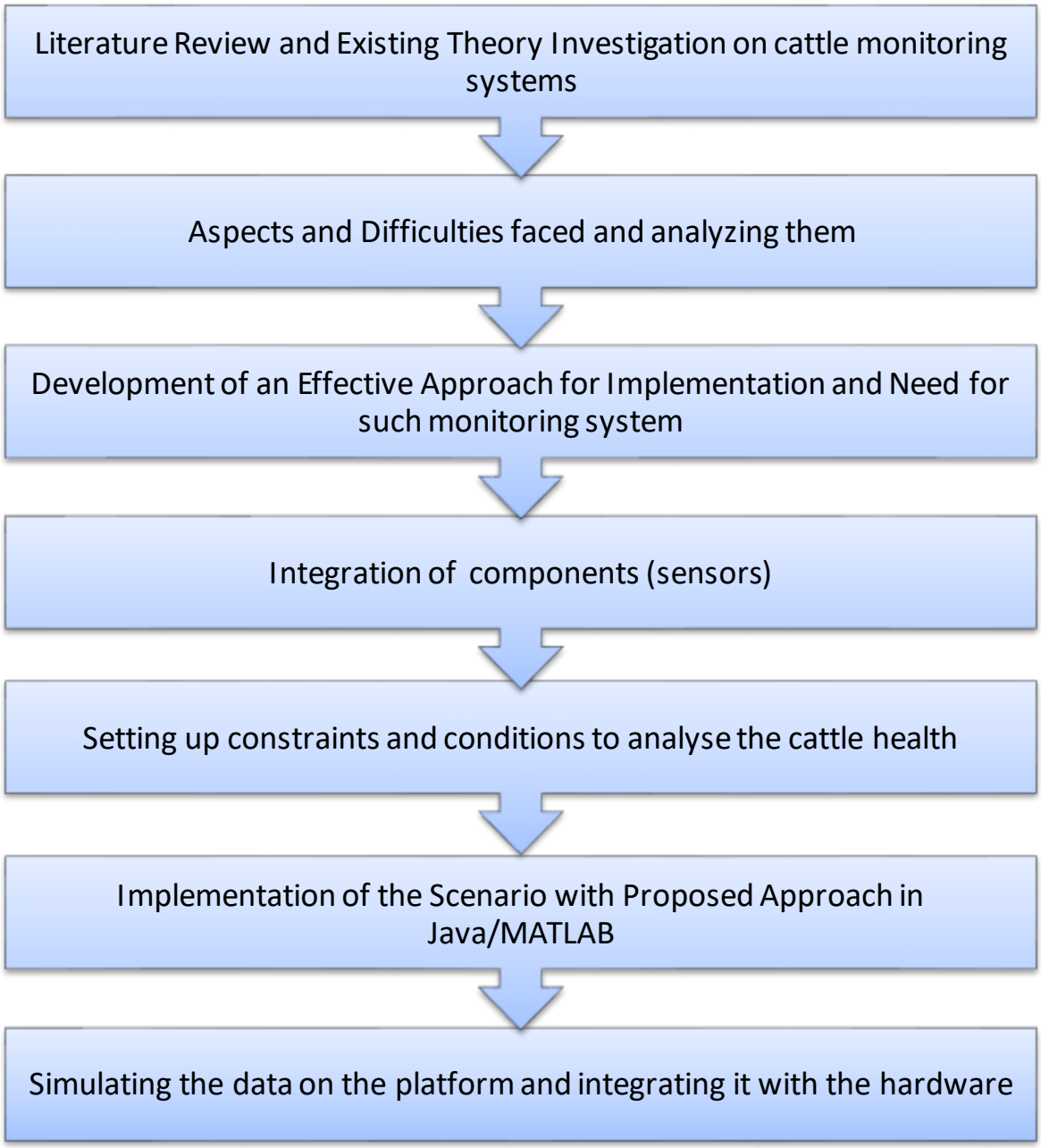

Fig1 : Flow chart for methodology

1.5 Applications

- Early detection of diseases in cattle
- Efficiency in milk production in diary farms
- Controlled monitoring of the cattle in farms
- Daily diagnosis of the affected animals
- Decreases manual labor

1.6 Organisation

Chapter 1 highlights and underlines the assorted vulnerabilities and problems to be overcome. In this chapter, the introduction to various concepts and techniques used in the implementation is covered.

Chapter 2 provides the detailed literature review from the research paper, books, journals and conferences are done in. In this chapter, the extracts from assorted research papers on various situations are taken.

Chapter 3 covers the system development which is the key aspect of this work. In this chapter, the proposed model, algorithm and related parameters are emphasized.

Chapter 4 demonstrates the simulation of usage results with the relative execution Analysis.. In this part, the simulated results and screenshots are uncovered to portray and shield the proposed work

Chapter 5 ends with the detailed conclusion and scope of the future work which guides the upcoming students and research scholars to enhance the current work with higher efficiency and effectiveness.

CHAPTER 2

LITERATURE SURVEY

2.1 Introduction

For completion, justification and solving the problem statement, a myriad of research papers, magazines, journals and online websites are examined in details. In this chapter, the details of research papers and journals are specified from where we have analysed the content and formulated the problem. Various research scholars and scientists has composed various research papers and discovered fabulous outcomes. This segment underlines every one of those examination papers and their concentrates.

2.2 Summary of papers

Table 1: Summary of research paper 1

Title of Paper	CATTLE HEALTH MONITORING USING WIRELESS SENSOR NETWORKS
Author	Kevin Mayer, Keith Ellis and Ken Taylor
Year of Publication	2011
Summary	The prerequisite for individual and group wide checking of creatures from a physical and physiological perspective rises up out of the method for the inconveniences required with directing farms with broad brushing regions. To explore these issues, they have instrumented a direct utilizing three MICA2 Berkeley Motes [a assortment of sensors, and a Ultralite GPRS unit by making a little remote system, which researches the inward workings of the creature without essentially meddling with it. It filled two need, first to test the capacities of bits and remote sensor systems for creature wellbeing observing, and to give a preparatory examination concerning development in a creature's

	rumen. The rumen is viewed as the creature's 'motor room', and gives the status of the creature wellbeing. The another most essential wellbeing variable is the interior temperature which is picked as the parameter in the analysis. Other wellbeing parameters that fills in as a reason for ranchers and veterinarians to decide the dairy cattle wellbeing incorporate weight, pH level, conductivity and other bio-estimations[1]
Web Link	https://www.academia.edu/781755/Cattle_health_monitoring_using_wireless_sensor_networks

Table 2 : Summary of research paper 2

Title of Paper	Wireless Sensor Networks in Agriculture: Cattle Monitoring for Farming Industries
Author	Kae Hsiang Kwong, Tsung Ta Wu, Hock Guan Goh, BruceStephen,Michael Gilroy, Craig Michie, and Ivan Andonovi
Year of Publication	2009
Summary	It is demonstrated that in the dairy cattle checking framework, the availability between each neckline with inbuilt sensors worn by the steers is be sporadic prompting an unsteady directing way which brings about expanded bundle delay. To beat the issue, an Implicit Routing Protocol (IRP) is displayed in the paper for the steers checking frameworks. The proposed convention works in the diverse stages: setup stage and information sending stage. In the arrangement stage, the base station intermittently surges a TIER message to every one of the hubs in the whole system. This TIER message has a base station's ID field, and a bounce tally field. The jump check field is utilized to tally the quantity of bounces the TIER

	message has gone from the base station. The levels are numbered beginning from the base station. A neckline in a given level, n, which speaks to it is n-th level far from the BS. This basic data is characterized as TIER ID. As creatures are free to move around, the base station is required to send a TIER message intermittently.. At the information sending stage, if the neckline is desired to report its deliberate information back to the base station, it will shape a parcel containing its current TIER ID and estimation information. This bundle is then communicated information to its region. Just collars which have a littler TIER ID will react with an affirmation (ACK).[2]
WebLink	http://piers.org/piersonline/pdf/Vol5No1Page31to35.pdf

Table 3 : Summary of research paper 3

Title of Paper	Development of Effective Cattle Health Monitoring System based on Biosensors
Author	Myeong-Chul Park1 and Ok-Kyoon Ha2
Year of Publication	2015
Summary	They outlined LMS that comprise of a biosensor module to gauge bio-signs of cows and a Zigbee module to transmit the biometric information to the gauging framework on the remote sensor organize. LMS utilizes an electrocardiogram (ECG), a drive detecting resistor (FSR), and an accelerometer to quantify the bio-signs of every individual cows. The crude information is separated utilizing a Band Pass Filter (BPF), a Low Pass Filter (LPF), and a High Pass Filter (HPF) to make advanced biometric information. The biometric information is then transmitted to a coordinated administration framework that stores the fundamental steers data utilizing a Zigbee WSN module after the signs

	are opened up utilizing a handling speaker. We executed both the biosensor module and the Zigbee WSN module as a coordinated gadget on a solitary board. We secured the coordinated module gadget and battery with a defensive aluminum box, and after that connected the band containing FSR to the storage compartment of the steers. For lower control operation, we quantified information for one moment after power is on. On the off chance that a flag has no issue, we killed the mistake LED and provided energy to the Zigbee module[5]
Web Link	http://onlinepresent.org/proceedings/vol117_2015/42.pdf

Table 4 : Summary of research paper 4

Title of Paper	Cattle Monitoring Using Wireless Sensor Networks
Author	Pieter De Cremer and Gilles Vandewiele
Year of Publication	2010
Summary	There are various business items and existing innovations as of now available. A. CowManager SensOor CowManager SensOor, imagined by a Dutch organization, is an electronic earpiece that sends data to a switch in the stable each 15 minutes.This framework utilizes the star organize plot without enhancements B. CowScout CowScout is an item worked in reproducing information.It utilizes a leg or neck label which consistently transmits information remotely to a long-run recieving wire. Information is then transmitted to the CowScout database for handling. The utilization of a long-go radio wire makes the framework more vitality expending.

	C. Medria Medria made 2 items for dairy cattle checking. To begin with, there is Vel'Phone ,a temperature sensor in the vagina, which refreshes day by day so as to track advent of calving. Besides, there is Heat Phone , which cases to recognize when creatures start oestrus (time of sexual receptivity) with a precision of 90%. D. Electronic Shepherd Electronic Shepherd began with a request from a rancher in Norway. In that locale the sheep are forgotten on their ownto touch up in the mountains amid the late spring and return inthe start of September. With a specific end goal to track them for foodsafety measures and to screen what number of get lost or got by predators an observing framework was constructed. The creatures of a run are furnished with minimal effort radios and transmit information to a rush pioneer that has a worldwide correspondence channel to the Internet. The utilization of satellite correspondence is costly contrasted with different frameworks, however the scope of versatility of the sheep anticipates utilizing different remote correspondence stations. The lifetime of the framework is sufficiently long to work independently for the period required before the creatures return, utilization of vitality era could be a reasonable choice for comparable frameworks where the creatures don't return home.[4]
Web Link	https://www.academia.edu/12747976/Cattle_Monitoring_

	Using_Wireless_Sensor_Networks

Table 5 : Summary of research paper 5

Title of Paper	Sensor-based M2M Agriculture Monitoring Systems for Developing Countries: State and Challenges
Author	Lutful Karim
Year of Publication	2013
Summary	Observing the conduct of creatures or cows that is, the manner by which they collaborate each other and move in the field are imperative to legitimately use the restricted field assets (e.g. grass). For this reason, Wark et al. propose sensor arrange based dairy cattle checking framework where Fleck-2 cows hubs (sensors) are put in a plastic box before putting into the collars that the creatures wear into neck. GPS, two batteries and radio receiving wire are likewise put in the neckline. The plan of the neckline is essential with the goal that creatures can't harm it effectively. Creators propose setting the radio recurrence reception apparatus level on top of the neckline. Zebra net is a related venture to screen zebras utilizing GPS situating information. Controlling creatures is a test in the farming frameworks on the grounds that their positional and mental state (e.g., stretch, seek, mind-set) are exceptionally hard to gauge. Additionally, their conduct relies on upon

	many components, for example, age, season, sustenance accessibility, temperature and so on. Sensor-based M2M systems can assume a vital part in conduct measure/control. In , Wark et al. concentrate on demonstrating dairy cattle conduct in view of their position and inertial information. For this reason, changing the inertial sensors is essential to get valuable data. A sensor alignment model is created in light of the conveyance of inertial information. For example, amid day time, the exercises of steers are significantly more than that of amid night. Thus, their brushing, ruminating, dozing (behavioral) information will have diverse shape in various time (e.g., day and night). Adjustment model depends on mapping these dataset to various parameters. From inertial sensors, information about the speed, turning rate and development vitality of steers can be gathered. These information help distinguishing cows conduct. Wark et al. additionally propose to incorporate radio recurrence distinguishing proof label (RFID) with sensor systems to record/track the measure of sustenance every creature takes and send this data through the systems.[6]
WebLink	http://www.macrothink.org/journal/index.php/npa/article/view/3787

Table 6 : Summary of research paper 6

Title of Paper	Animal Behaviour Understanding using Wireless Sensor
Author	Y. Guo1, P. Corke1, G. Poulton1, T. Wark1, G. Bishop-Hurley2, and D. Swain2
Year of Publication	2006
Summary	.Domesticated animals checking should have the capacity to adapt to creatures' portability and development. Therefore, correspondence joins should have the capacity to manage this portability and have the capacity to cover long separations between hubs. CSIRO ICT Center's Autonomous Systems Lab has built up a remote sensor organize test bed for ecological and creature conduct observing at an exploratory homestead covering three enclosures (see Figure 2). In the proving ground, settled ecological hubs are sunlight based controlled, and together with the versatile creature hubs, shape a model for deal with the "brilliant ranch" without bounds. The hubs utilized in these analyses are CSIRO created Fleck2 (120mm × 60mm) gadgets ,with distinctive sensor designs, all running TinyOS furthermore, utilizing Deluge for code download. The Fleck2 was particularly intended for applications in creature following and control. It is a reduced and minimal effort remote sensor equipment gadget with a different number of sensors including GPS, 3-pivot speeding up, 3-hub attractive field quality and temperature, and additionally the capacity to store extensive measures of information.[7]
Web Link	https://pdfs.semanticscholar.org/3553/03daf46c05bd693efe0e2980afdf5d5cb7ae.pdf

2.2 Websites Referred

We referred this site for getting acquainted with the common diseases and maladies in cattle animals.

https://www.Principles of Animal Diseases

2.2.1 Common diseases in cattle animals (cow)

Maybe the absolute most very affecting condition influencing bovine efficiency is fetus removal, trailed by execution influencing or incapacitating conditions, for example, internal parasites, weakness or footrot. In well managed herds groups, clostridial or viral sicknesses bringing on systemic or respiratory trouble are uncommon. Be that as it may, conditions achieved by environmental stressors, for example, warm, drought, nitrate-or other toxic concentrating plants might be fairly normal.

Abortion

Several factors and organisms cause abortion at any point during the gestation period. Of particular interest are the effects of the Bovine Viral Diarrhea(BVD) virus on the fetus. When cows are infected early after fertilization, they may have reduced conception. Then, infection during the first four months of gestation may lead to embryonic death, abortion, growth retardation and persistent infection (PI-infected calves). Congenital malformations occur when the fetus is infected during month four to six of gestation. Fetal mummification, premature births and weak calves are also seen in fetal infection with BVD virus. Other conditions such as heat stress, exposure to toxins from forbs, and listeriosis also lead to abortions at any time during gestation.

Footrot

This condition is brought about by a pathogen exhibit in the dirt, which taints the foot tissue when conditions are correct (wet, sloppy conditions).

Wasting ailments

Both tuberculosis and Johne's ailment are brought about by microscopic organisms of

similar species (Mycobacterium),and both prompt diminished execution, general squandering, and, on account of tuberculosis, effects on between state and universal exchange. [2].

https://www.Diseases and Parasites of Cattle.

Parasites

Two principle sorts of parasites cause execution misfortunes in bovines and calves.

Interior parasites

Frequently prompt decreased drain generation and light weaning weights. Very much oversaw groups depend on convenient de wormer applications to lessen effect of parasite loads on remote sensor execution. Fasciolahepatica and Fascioloides magna upset liver capacity and prompt weight reduction and lessened weaning weights. [8]

Outside parasites

For example, flies or ticks are likewise known to influence dairy animals and calf execution. Mishandle or abuse of particular bug sprays may prompt advancement of resistance in influenced creepy crawlies.

Temperature

Body temperature is a critical parameter for evaluating creature stress.that is to state it cautions for ailment and illnesses. In any case, getting information in the field is time and work serious, which addresses the requirement for arrangements that give consistent and programmed securing of these parameters.

Endeavors to quantify body temperature of steers have been made at different anatomical areas including rectum, ear (tympanic), vagina, reticulum-rumen, and udder (drain). Rumen temperatures have been exhibited to be successful measures of center body

The ordinary center body temperature of a solid, resting dairy animals is expressed by and large to be 101.5 degrees Fahrenheit (38.6 degrees Celsius). A bovine's body temperature must be kept up inside thin points of confinement so as to maintain its physiological procedures. Concurring to some of the scientist discoveries the range is observed to be 100 to 104 °F [37.8 °C to 40.0 °C]. [11]

Dairy cattle body temperatures ascend amid the day as opposed to the creatures spending vitality to dispose of the warmth. Least body temperature as a rule happens at a young hour in the morning, then relentlessly increments amid the day.

Body temperature ascends in dairy cattle contaminated with a sickness bringing on living being as the invulnerable framework battles the disease. There are some untreated dairy cattle which many defeat contamination and recoup, while others endure lifted body temperatures and hint at different sickness.

CHAPTER-3

SYSTEM DEVELOPMENT

3.1 Introduction

System development specifies the details of the application or the implemented model proposed in the project . It specifies whether the proposed model works on the concept or guidelines of analysis, computation, experiments or mathematic results . It displays Sequentially the analysis done in the project, its basic outline or design, the development features and the algorithm used to successfully implement the idea practically

3.2 Technologies used

3.2.1 Wireless Sensor Networks *(in context with cattle health monitoring)*

Sensor Nodes

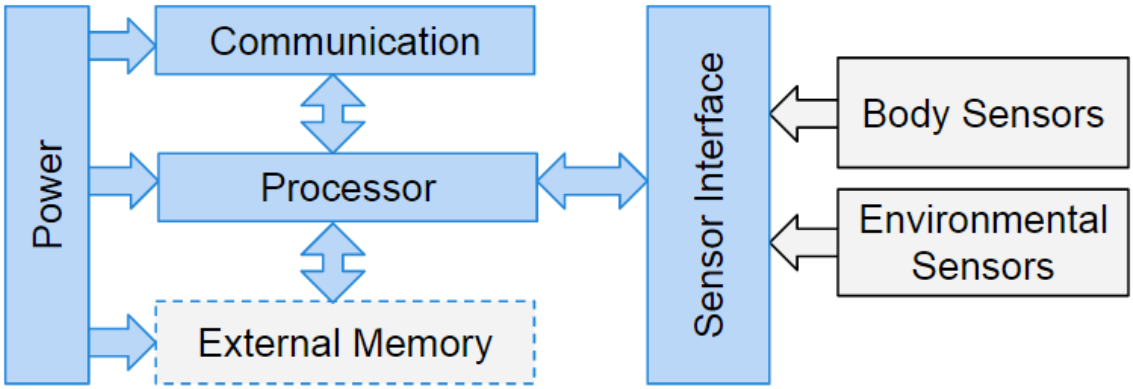

Figure 2: Sensor node architecture[1]

A wireless sensor node is a basic unit of a WSN. It involves four fundamental modules and associated sensors. These incorporate a sensor module, utilized for simple to-computerized change and sensor communication, a power module ,the communication module to transmit information and a computational module. [4]We can also attach a

optional module for an external memory which can provide method to aggregate the data

Market is full of variety of sensors which are further divided into:

- body sensors
- environmental sensors

Body sensors measure internal conditions of the animal itself. Sensors like for example; localization sensors, blood pressure, heart beat sensors, Accelerometers hung around the neck to detect feeding, thermometers in the cattle's intestines etc.

Environmental sensors are used to observe the external parameters like climate observation. For example sensors like thermometers sensors to check vacillations in temperature, pressure sensors , humidity index sensors, pasture level sensors etc. It is not necessary attached to the animal. [10]

Wireless Communication Technology

Table 7: Different types of wireless technology

Wireless Networking Technologies						
	ZigBee	Bluetooth	UWB	Wi-Fi	LonWorks	Proprietary
Standard	IEEE 802.15.4	IEEE 802.15.1	IEEE 802.15.3a (to be ratified)	IEE 802.11a, b, g (n to be ratified)	EIA 709.1, 2, 3	Proprietary
Industry organizations	ZigBee Alliance	Bluetooth SIG	UWB Forum and WiMedia Alliance	Wi-Fi Alliance	LonMark Interoperability Association	N/A
Topology	Mesh, star, tree	Star	Star	Star	Medium-dependent	P2P, star, mesh
RF frequency	868/915 MHz, 2.4 GHz	2.4 GHz	3.1 to 10.6 GHz (U.S.)	2.4 GHz, 5.8 GHz	N/A (wired technology)	433/868/900 MHz, 2/4 GHz
Data rate	250 kbits/s	723 kbits/s	110 Mbits/s to 1.6 Gbits/s	11 to 105 Mbits/s	15 kbits/s to 10 Mbits/s	10 to 250 kbits/s
Range	10 to 300 m	10 m	4 to 20 m	10 to 100 m	Medium-dependent	10 to 70 m
Power	Very low	Low	Low	High	Wired	Very low to low
Battery operation (life)	Alkaline (months to years)	Rechargeable (days to weeks)	Rechargeable (hours to days)	Rechargeable (hours)	N/A	Alkaline (months to years)
Nodes	65,000	8	128	32	32,000	100 to 1000

Table 1 condenses the most as often as possible utilized wireless communication technologies and their properties. Each of the technologies are suitable for particular circumstances and specific situations. For example when in a situation a high data rate is required 802.11 and its long-extend adaptation 802.11ah outperform the different technologies. At the point when to a great degree long ranges are fundamental, cellular communication advances ought to be used. These advancements are exorbitant, yet they are simple to deploy in light of the fact that an operator network can be utilized.

At the point when the range is constrained, more get to focuses or repeaters are required or multi-hop could be utilized, which is talked about in III-B. In cattle monitoring frameworks battery life is a basic significance, so Zigbee and Wibree are compatible potential competitors. Since the bandwidth of Zigbee can be brought down, a higher range can be accomplished. The measure of the data and communication frequency that is being imparted greatly affects the battery life. When frequent communication is required , methods for expanding the lifetime must be considered, which are tended to in IV.

Design of antenna

All communications frameworks ,it consists of antennae, transmitter and receiver. These are not really same for the base station and the sensor hub. For the base station receiving wire, tests have demonstrated that design of antenna configuration can intensely impact availability . To analyse which height is optimal for the antenna research was directed and has demonstrated that the received power turns out to be less sensitive to the separation of the cows when the antenna height is more prominent than four meters.An awesome test for the outline of the sensor hub reception apparatus is the constrained entrance of fat and muscle tissue. Remote correspondence signals can't enter the whole width creature's neck. In the event of neckline based sensor hubs, two reception apparatuses, one on each side of the creature, ought to be connected keeping in mind the end goal to give Omni-directional correspondence.

At last, the receiving wires must not be too overwhelming or too big(event hough expanding the radio wire size could build the productivity, on the grounds that the steers will attempt to demolish the gear when this causes distress .

Type of Data transport schemes

Another imperative variable that impacts the performance of the framework is the data transport scheme. As specified, appropriated sensor hubs gather information and send it to a sink node. The sink hub can have generally high computing power to do some essential handling. Nonetheless, the heft of the computational work will in any case be done in cloud services. Wireless sensor networks ordinarily have a constrained reception antenna range. Since animals tend to roam uninhibitedly in the field they may not generally have a direct connection to the sink hub. Keeping in mind the end goal to dependably gather the data from the sensor hubs various transport plans could be deployed to advance the availability[5]

1. **Star Network**

Many cattle health monitoring routing scheme is that of a star network.

Each sensor node in the network can only communicate directly with the sink node. In this scheme each sensor node is a ”client” while the sink node is the ”server”.

The right now utilized steering plan is that of a star network. Each sensor hub in the system can just communicate directly with the sink hub. In this plan every sensor node is a "customer" while the sink hub is the "server".

2. **Multi-hop**

In this plan a sensor hub can convey straightforwardly with other sensor hubs, along these lines they can be utilized as routing nodes in the system. Presently information of an objective hub can be handed-off to the sink hub by other sensor hubs. With a specific end goal to do this, a tree system is made where information from the furthest hubs are collected in hubs nearer to the sink hub and handed-off until all data is gathered .Since the steers are portable the system topology must be recalibrated frequently, conventions such as On-Demand Multicast Routing Protocol or Implicit Routing Protocol could be utilized. The multi-hop routing plan is the best when creatures can't wander too a long way from the sink hub or each other. Exploratory results have demonstrated that the convention is most appropriate for dairy bovines inthe winter, when they are housed in pens. It plays out the best for homesteads with extensive number of dairy animals, since a high thickness of animals enhances the likelihood of building up reasonable links between the cows and make a powerful way to the sink hub

Advantages of WSN in cattle health monitoring system:-

- Network setups should be possible without settled foundation.
- Ideal for the remote places, for example, over the ocean, mountains, rustic territories or profound timberlands.
- Flexible if there is specially appointed circumstance when extra workstation is required. Cost of implementation is low.
-

Disadvantages of WSN in cattle health monitoring system:-

- It is expensive technique for little agriculturists.
- Less safe in light of the fact that system hackerss can enter the access point and get all the data.
- Lower speed contrasted with a wired system.
- Complexity of the network is more than a wired framework.
- Easily affected by environment (dividers, microwave, and expansive separations because of flag constriction).

3.2. 2 JAVA

Java is characterized by a specification and comprises of a programming dialect, a compiler, libraries and a runtime (JVM).The run time environment enables programming engineers to compose program code in different dialects than the Java programming dialect which still keeps running on the Java virtual machine. The Java language was conceptualised with the following properties:-

- Platform independent: Java programs utilize the Java virtual machine as reflection and don't get to the working framework straightforwardly. This makes Java programs exceedingly versatile. A Java program (which is standard-consistent and takes after specific principles) can run unmodified on every single bolstered stage, e.g., Windows or Linux.

- Object-orientated programming: All elements in Java are objects leaving the primitive data types.
- Strongly-wrote programming dialect: Java is specifically, e.g., the sorts of the utilized factors must be pre-characterized and transformation to different articles is generally strict, e.g., must be done as a rule by the software engineer.
- Interpreted and arranged dialect: Java source code is moved into the byte code organize which does not rely on upon the objective stage. These bytecode directions will be translated by the Java Virtual machine (JVM). The JVM contains a supposed Hotspot-Compiler which deciphers execution basic bytecode directions into local code guidelines.
- Automatic memory administration: Java deals with the memory assignment and de-designation for making new protests. The program does not have guide access to the memory. The purported junk jockey consequently erases items to which no dynamic pointer exists.[9]

3.3 Proposed model and Project Design

The project aims at monitoring the cattle health using wireless sensor network. It includes a module to collect the health data using Arduino as the hardware unit Next it comprises of another module transmit the collected data to the respective base station through LEACH algorithm for further processing of the data.It also includes a module in JAVA to test the threshold values of various health parameters like temperature, heart rate etc and generate the periodic reports to the health centres.

Hence the model proposed works and comprises of three procedural phases :

1. Collection of data through sensors.
2. Routing the data to the base node.
3. Processing and monitoring the data.

Hardware requirements

Minimum requirements needed to perform operations are:-

- Arduino UNO Development Board
- Pulse Sensor
- Bluetooth Sensor(HC-06)

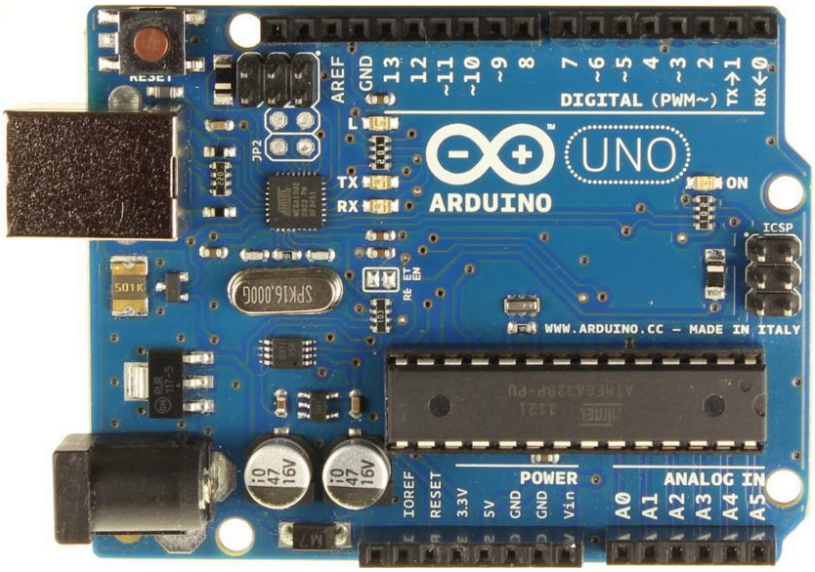

Fig 3: Arduino UNO

Fig.4 :HC-06 Bluetooth module

Fig 5: Pulse sensor

Software requirements:-

The software required to perform the implementation are

- Windows or Linux Operating System (Ubuntu)
- MATLAB
- JAVA
- Android
- Arduino mobile application
- Arduino 1.6.1 IDE
- Netbeans

1 .Collection of data

For collection of the data, we used a pulse sensor which determines the heart rate serving as the basis to identify the health status of an animal. Heart rate is an extremely fundamental wellbeing parameter that is specifically identified with the soundness of the human cardiovascular framework. This project depicts a method of measuring the heart rate through a fingertip utilizing a arduino. While the heart is thumping, it is really pumping blood all through the body, and that makes the blood volume inside the finger artery route to change as well. This vacillation of blood can be recognized through an optical detecting component put around the fingertip. The signal can be intensified further for the microcontroller to tally the rate of change, which is really the heart rate.

This project module uses the pulse sensor with arduino uno and Bluetooth HC-05 module, The pulse sensor is placed on the finger and it measures the heart rate and then sends the heart rate to android mobile via bluetooth device.

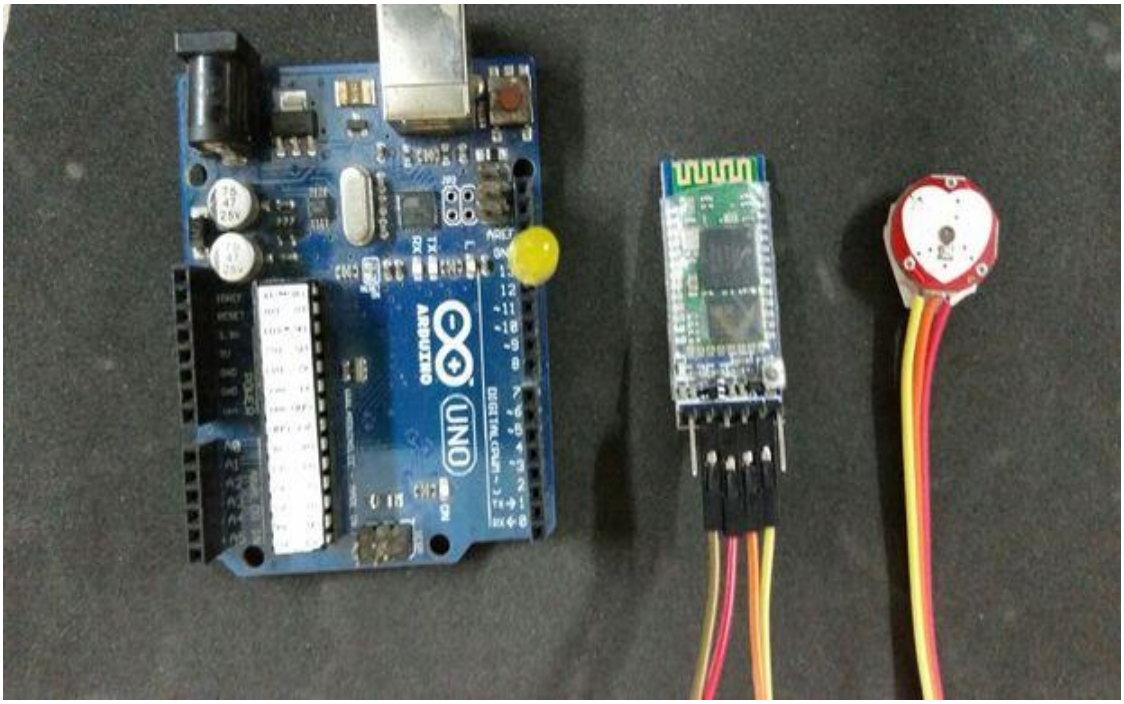

Fig 6 :Module 1

1. Routing the data to the base station

Wireless Sensor Network (WSN) have a major role as they maintain the routes in the network, data forwarding, and provide reliable multi-hop communication. The main requirement of a wireless sensor network is to prolong network energy efficiency and lifetime. Wide known scholars have developed protocols like Low Energy Adaptive Clustering Hierarchy (LEACH) for optimizing the energy consumption in the network.
LEACH offers significance importance because a node in the network is futile when its battery dies while LEACH protocol allows to space out the lifespan of the nodes, providing it to do only the minimum work needs to transmit data as the following FIG 7 shows.

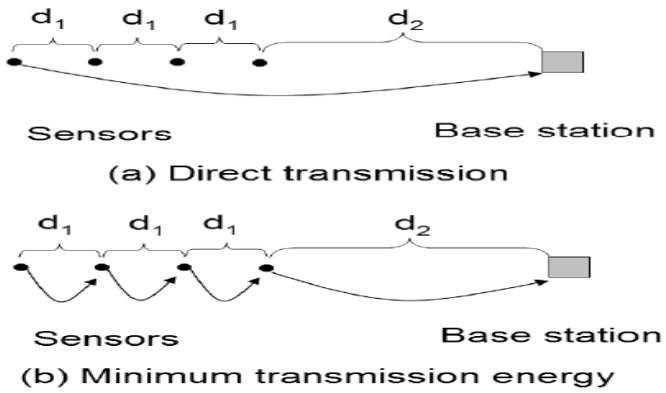

Fig 7: Benefit of Leach Algorithm in the module[13]

The LEACH algorithm works in two phases: -

- The Set-Up Phase
  - It is the phase where cluster heads are chosen
- The Steady-State
  - It is the phase where the cluster head is maintained and data is transmitted between nodes

Cluster-heads are chosen stochastically (randomly) in the module where:-
If n < T(n), then that node becomes a cluster-head
The Stochastic Threshold Algorithm algorithm works in the way so that each node becomes a cluster-head at least once.

$$T(n) = \frac{P}{1-P\ x(r mod\ P^{-1})} \qquad \forall n \in G$$

$$T(n) = 0 \qquad \forall n \notin G$$

Where n is a random number between 0 and 1
P is the cluster head probability and
G is the set of nodes that weren't cluster heads the previous rounds

2. Monitoring and Processing the data at the base station

In this module we validate the information collected by the sensor and apply the threshold to check the condition of the cattle animal in the farm ,thereby notifying the results .

Characteristics of cattle abnormal condition

Cattle animal have motion and pronunciation to communicate their expression and behaviour.. This information can be used to check cattle's status that is physiological, mental and disease state. When animal ie cow here has a abnormality, characteristics of unusual condition. Are classified as stress, estruses, death and stolen.

Table 8: is characteristics of cattle movement in unusual condition.

Abnormal condition	Activity Characteristics	Outcome
Stress	Violent behavior is frequent	Decrease activity
Disease	Behavior is not active and out of community	Increase activity and grouping
Death	Stationary state	No activity

Stolen	Out of livestock farm	Cannot be detected

At the point when dairy animals has malady, delivery, stress, estruses, demise of cow and stolen status, demonstrate qualities of strange condition. Mating season estruses is attributes that expansion development and group than common day and enhance action around 3~4times then non-estruses dairy animals. The vast majority of dairy animals before the delivery diminish development and movement, they will make new gathering after out of group. At the point when bovines get push, which is atmosphere, commotion, condition of search and water, conduct progresses toward becoming to build more successive extreme exercise and development by harming delicate, muscle solidness, enlarged breath and ascent of circulatory strain and height of glucose levels. Demise of dairy animals is non-action and stolen of bovine is out of cattle farm which can't identify them in domesticated animals cultivate. . It has objects such as Temperature-Humidity ,Pressure index Index, Daily activity and normal value. To provide proposed alarm service with user, compare collected information from cattle farm with standard value

Chapter 4

Performance Analysis

4.1 Introduction

Performance Analysis is the provision of objective feedback to the performers or the developers undertaking or implementing a project trying to get a positive change in performance.

4.2 Results and Analysis

Following are the results and outputs after implementing Module-I procedurally:

- The Pulse Sensor Amped is a fitting and-play heart-rate sensor for Arduino. It basically consolidates a basic optical heart rate sensor with intensification and commotion cancelation hardware making it quick and simple to get dependable heartbeat readings.

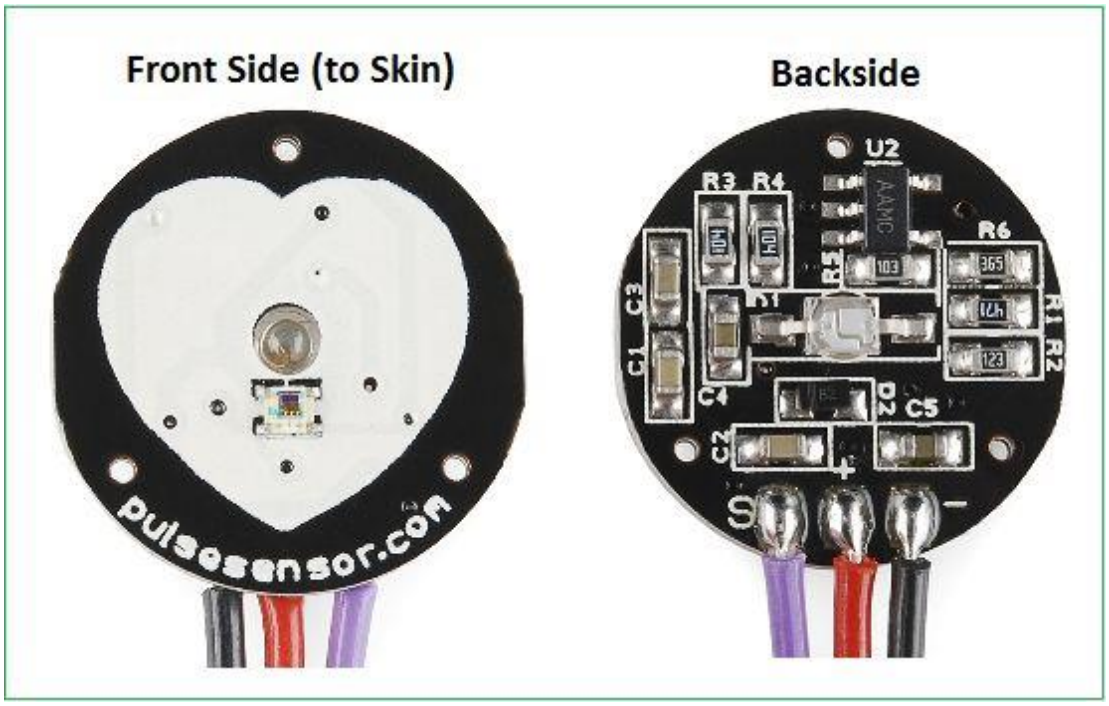

Fig 8: Properties of a pulse sensor

- Connect the sensor's energy supply pins to the arduino board supply stick as Red – 5V, Black – GND and Purple – A0 (simple information 0) its over. This Analog info perusing can be shown in serial terminal of Arduino IDE or it can be drawn as heartbeat by utilizing Processing IDE.

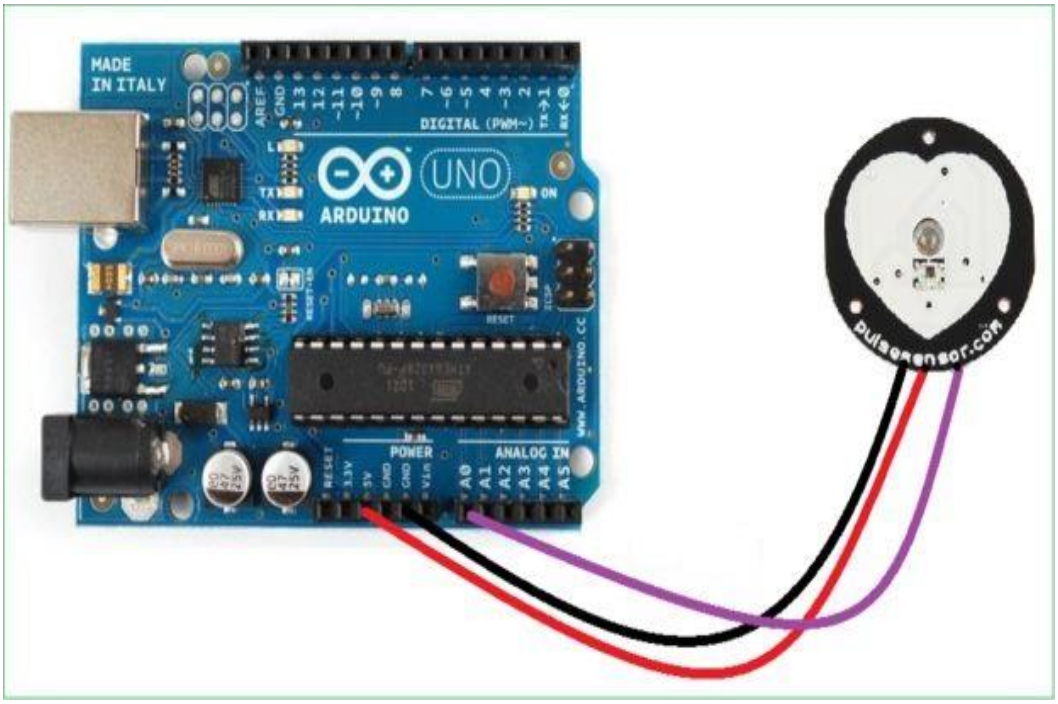

Fig 9: Final Connection of the hardware

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- After the connections are made successfully following output is received.

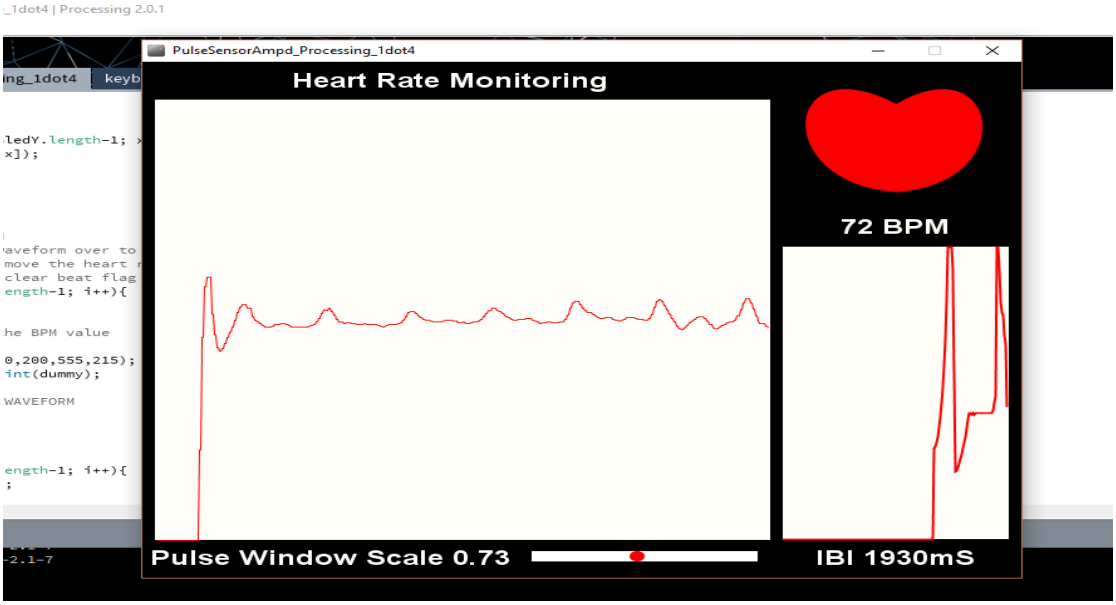

Fig 10: Result of Module 1

Following are the results and outputs after implementing Module-II procedurally:

- In this phase we need to send the data from all the nodes to the sink node i.e the base station for the processing. For this we apply LEACH protocol in wireless sensor network for sending the data in clusters.
- In this we consider a field of dimension 100 X 100 with 50 cattles in the field.
- It randomly creates 50 nodes and check for clusters after every round with maximum round set to 200.
- During the clustering when the cluster heads are being made.

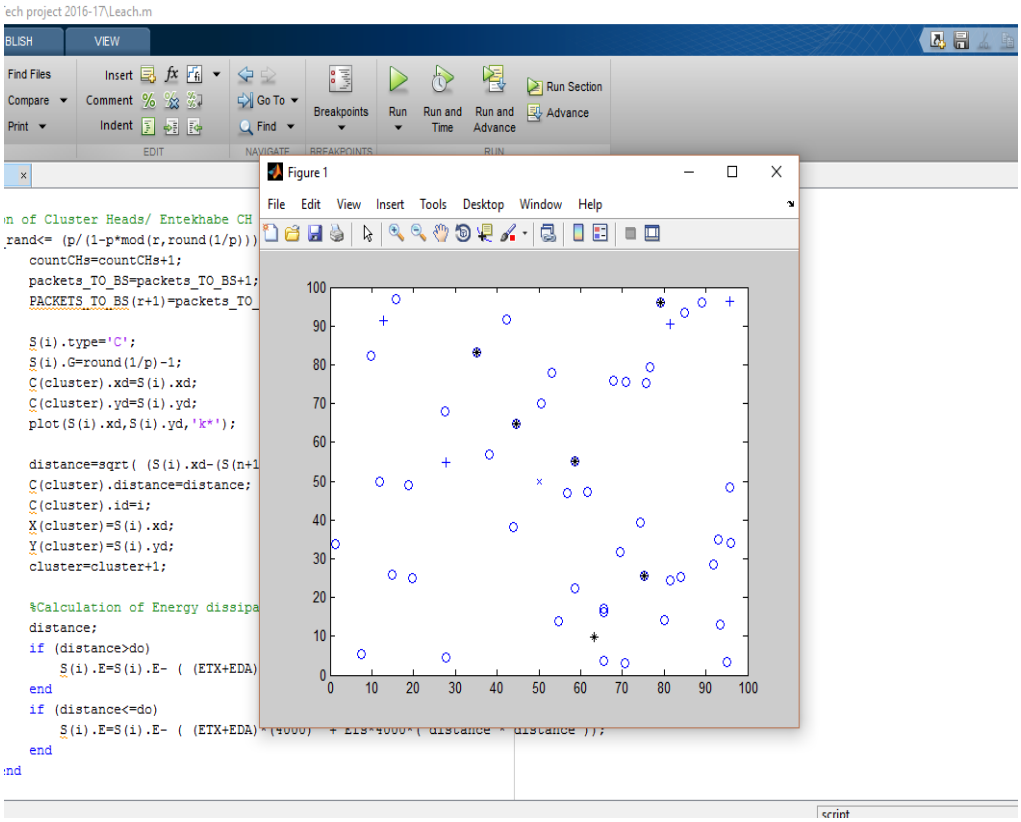

Fig 11 : Applying LEACH algorithm

- This is when the cluster heads are decided after the maximum 200 rounds.

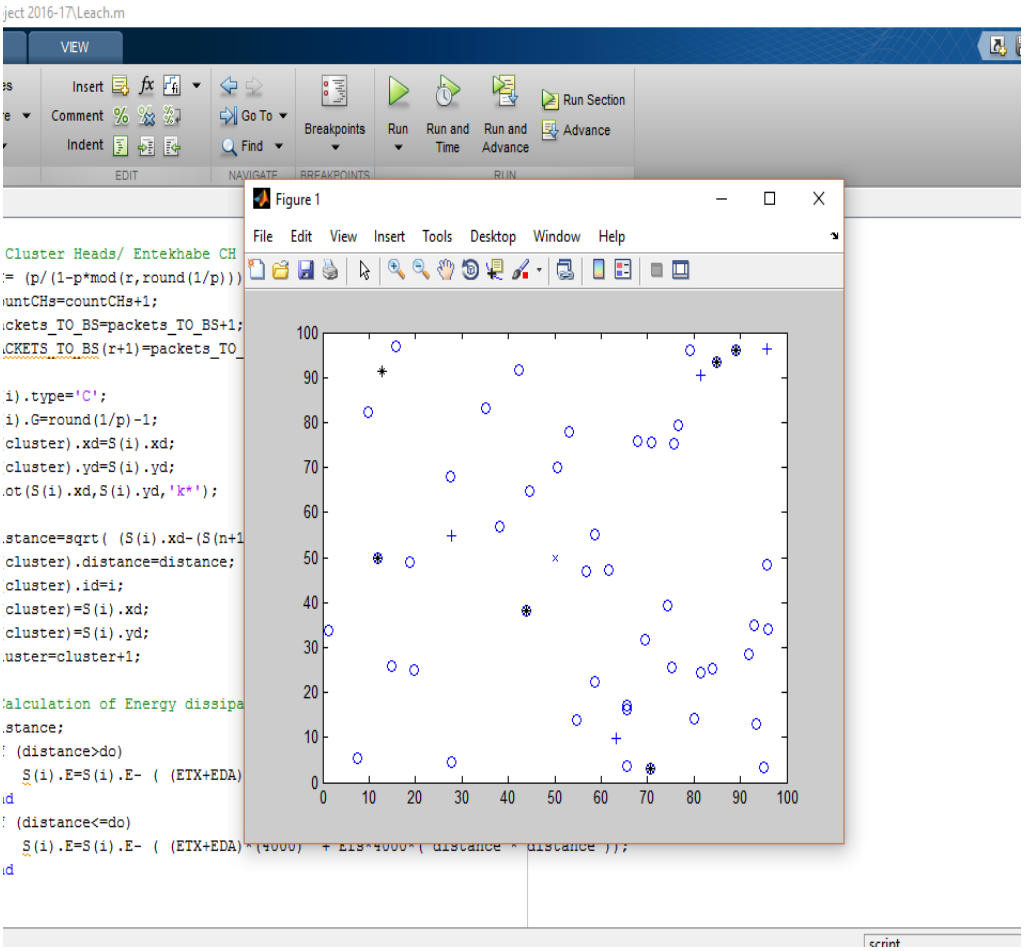

Fig 12 : Formation of clusters

- Following results are obtained.

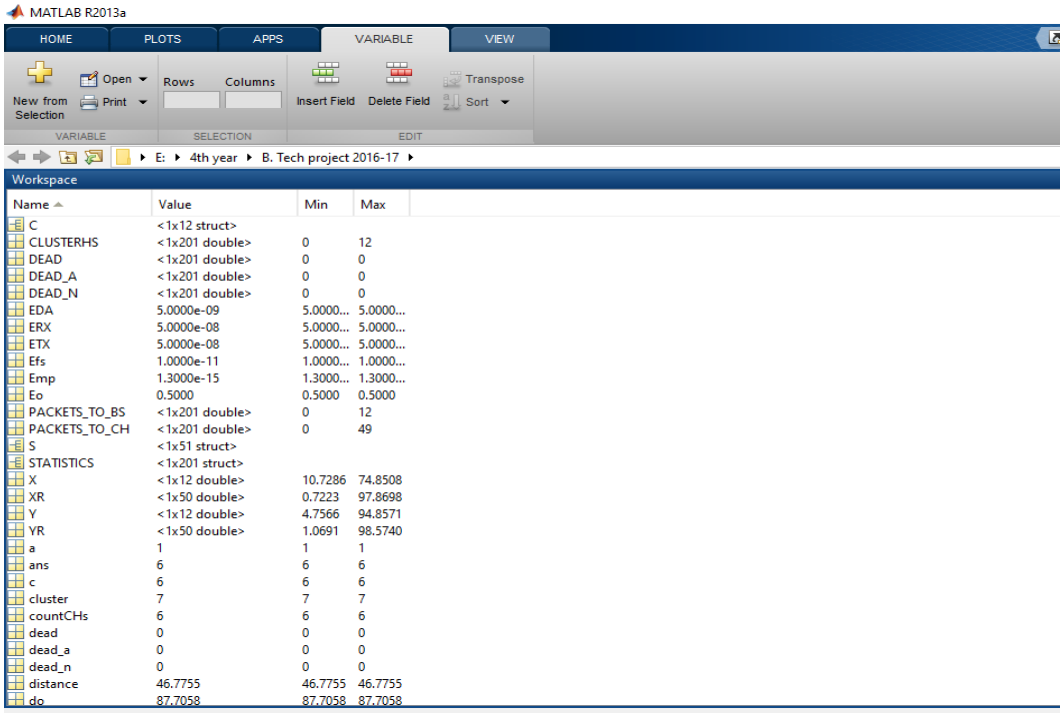

Fig 13: Result 1 obtained in Module II

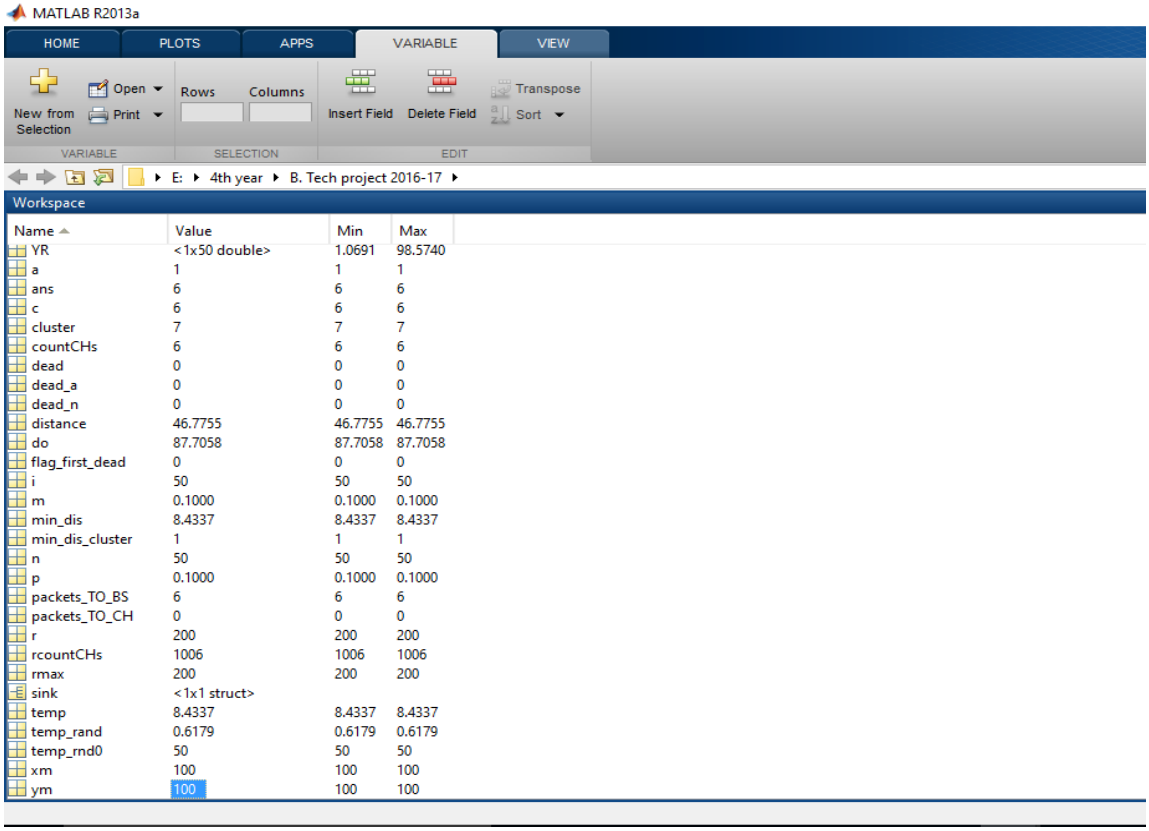

Fig 14: Result 2 obtained in Module II

Following are the results and outputs after implementing Module-III procedurally:-

- The following result is now received at base station for processing and checking the threshold values. This part is implemented in java and following threshold conditions were checked according to the survey.

Table 9 :Thresholds applied in Module III

Condition	if-clause	then-clause
Stress() (HeartBeat Sensor0	Temperature-Humidity Index > Standard value & Daily activity > Standard activity & Daily community > Standard	Stress alarm service
Disease() (HeartRate and Temperature Sensor)	Daily activity < Standard activity & Daily community < Standard community	Disease alarm service
Death()	Daily activity == 0	Death alarm service
Stolen()	Daily activity == 0 & non-detectable	Stolen alarm service

- In this phase of checking, the results are checked after various intervals and three days record is collected to show the behaviour at different intervals.

- **Day -1**

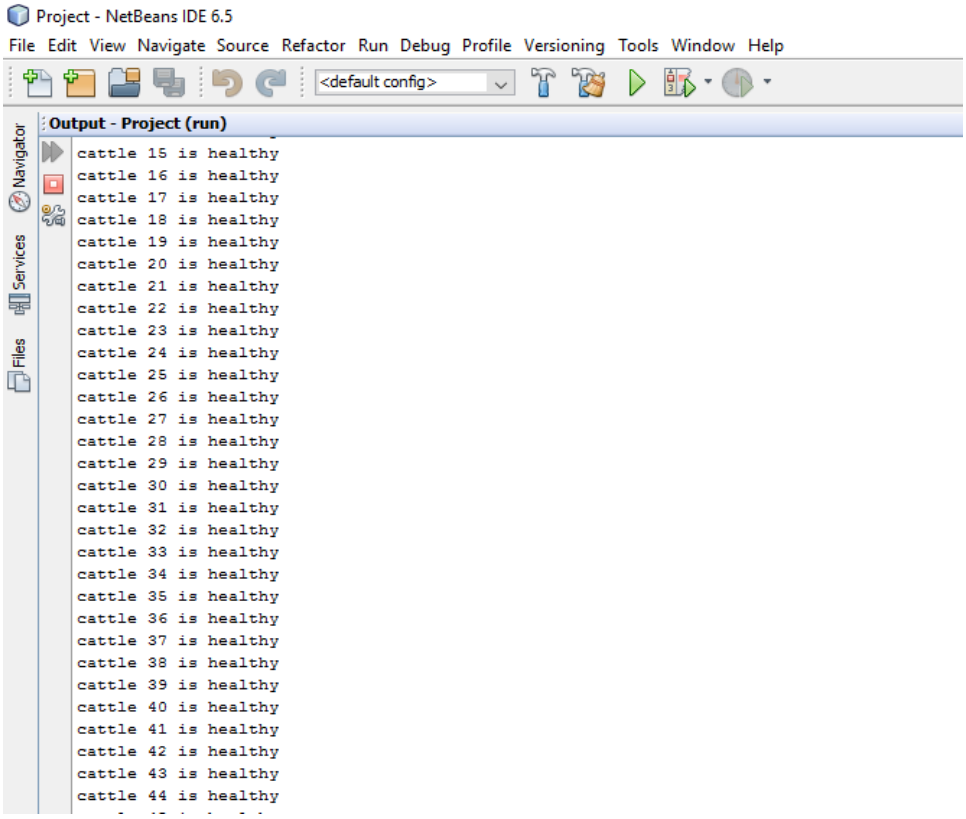

Fig 15: Result 1 obtained in Module III for day 1

- **Day-2**

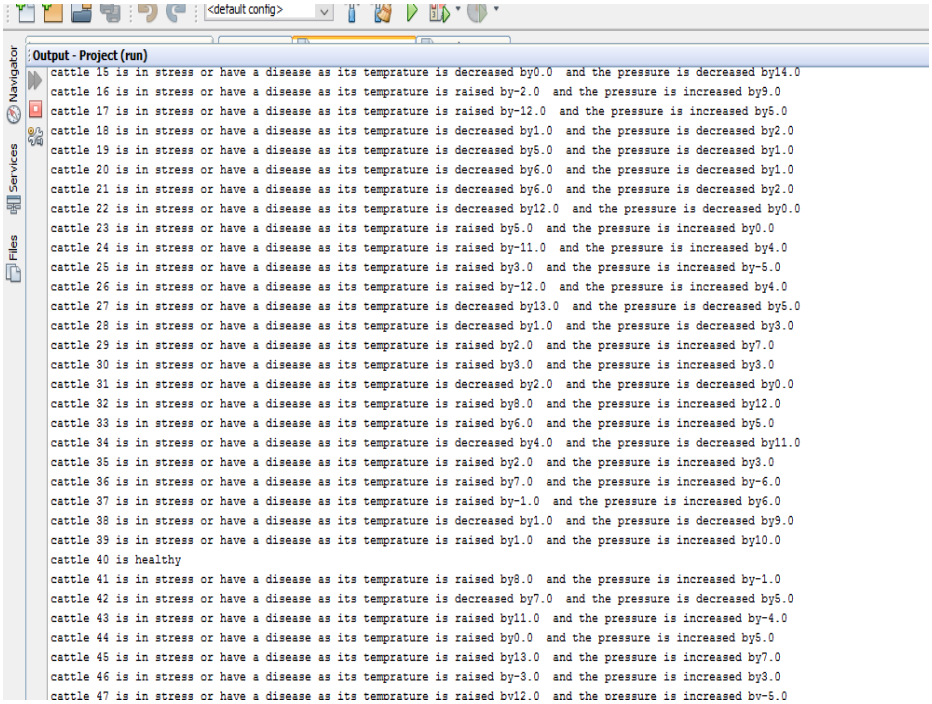

Fig 16: Result 2 obtained in Module III for day 2

- **Day-3**

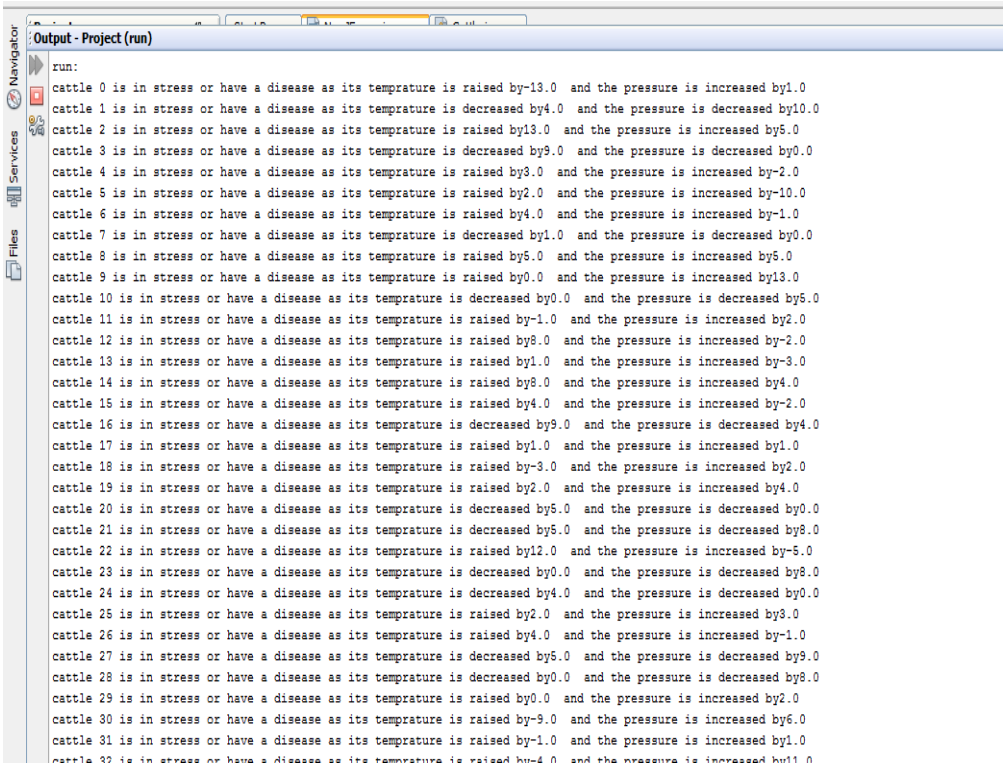

Fig 17: Result 3 obtained in Module III for day 3

This examination investigates the plausibility of utilizing minimal effort, low power utilization wireless sensor network framework for animal monitoring system. To encourage constant revealing while at the same time conquering portability brought about by animal motion a an Leach Algorithm is embedded to send the data packets in an efficient manner. The experimental results indicated that the proposed architecture can successfully resolve the broken routing path problem caused by animal mobility study its operation and apply the thresholds to detect the distress conditions in the cattle farm.

CHAPTER 5
CONCLUSION

5.1 Conclusion and Future Work

We presented a cattle health monitoring system using wireless sensor networks that collects vital information of each cattle, such as the heartbeat using a pulse sensor to help forecast livestock diseases using sensors based on WSN.

We will implement an integrated device including a sensor module and a Zigbee WSN module on a single board for easy installation on the neck of the cattle. Further we will aggregate the status of the animal's conditions by using other health parameters like position using a accelerometer and temperature using a temperature sensor .

We also plan to verify the validity of the cattle health monitoring system by comparing the results measured by a commercial ECG equipment for cattle to those of our proposed model in terms of the heartbeat and the pulse rate, and will subsequently gather the average correlation coefficient.

Along these lines, the insinuate association with its prompt physical condition enables every sensor to give restricted estimations and detailed data that is difficult to acquire through customary instruments. More work is required for the examination of accelerometer information, heart rate and early forecast of infection and data total in a gathering of nearby/local databases.

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