



# **An Undergraduate Internship on IoT Based Advisory Services for Agricultural Support**

By

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**Spring, 2022**

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Dissertation submitted in partial fulfillment for the degree of Bachelor of  
Science in Computer Science

Department of Computer Science & Engineering

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# Attestation

I, Mohammed Khaled Hossain, hereby declare that I have undertaken 12 weeks of internship at iFarmer Ltd starting from 16th January 2022 to 16th April 2022. All the work presented here in the internship report to be submitted to Independent University, Bangladesh is accurately representing the record of tasks and activities from internship period with the titled company I was in commitment with.

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Signature

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Date

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Mohammed Khaled Hossain

# Acknowledgement

The successful completion of my internship and articulation of this report would not be possible without the tremendous support and assistance from both of my academic and internship supervisors. I would like to this moment to express my admiration towards them and all the individuals who have offered me kindness throughout the journey.

I sincerely would like to express my gratitude to the Almighty Allah, the most merciful and beneficial, for empowering me to attend the internship with dignity and enable me to successfully prepare the report within the scheduled time.

I would like to extend my sentiment of gratitude and respect towards my academic supervisor Mohammad Motiur Rahman, Lecturer, Department of Computer Science Engineering, Independent University, Bangladesh – who has been a constant source of inspiration and encouragement as my academic supervisor.

I owe my deepest gratitude to Mr. Jamil M Akbar, Chief Operations Officer of iFarmer Ltd, my internship supervisor, for his willingness to support, and for providing me an amazing as well as productive platform for learning. His generous contribution to my work has tangibly helped in improving the quality of my internship report and bringing it forwards to its present status.

Thanks to family and classmates for always helping directly or indirectly to accomplish my task. Last but not the least, I thank all my professors, who prepared me to embark on this journey.

# Letter of Transmittal

22nd April, 2022

Mohammad Motiur Rahman

Lecturer

Department of Computer Science Engineering

Independent University, Bangladesh

Subject: Submission of the Internship Report of Spring 2022

Dear Sir,

I am submitting my report on Internship at iFarmer Ltd. I started my internship on January 16th, 2022. So, it has been almost more than two months that I am doing my internship. I have prepared this report based on my two-month learning in iFarmer Ltd. Throughout the report, I tried to introduce the comprehensive nature of the iFarmer Ltd eco-system. I mentioned the challenges personally I felt iFarmer Ltd is facing as a whole. At the end of the report, I have tried to incorporate my recommendation based on my academic learning to face the challenges.

I would like to express my heartiest respect and gratitude to you for your all-out support and guidelines for making my internship productive. Also, I would like to take this opportunity to thank you for facilitating my undergrad academic learning in Independent University, Bangladesh (IUB).

Thank you.

Sincerely yours,

Mohammed Khaled Hossain

ID: 1731367

# Evaluation Committee

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Signature

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Supervisor

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Signature

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Internal Examiner

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External Examiner

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Convener

# Abstract

The main objective of this internship to deliver advisory services to the farmers using innovative technology such as IoT sensors, remote sensing and machine learning solutions to measure and monitor key parameters and offer customized advisory for crop farming, and livestock dairy farming. This internship also gave me a hands-on opportunity to inculcate with the corporate or business culture aligned with my academic exposure. We use data and tech enabled field force to ensure transparency, efficiency, and scalability in understanding the needs and behavior of the farmers, offer tailored finance, input, advisory services and create market access for them. Data and Technology driven approach helps us to effortlessly monitor farmers and every step of the farming process. This internship has widely improved my desired skill and created a platform for me to solve real-life corporate problems through my engagement. This report will take us to all the details of me gathering the experience and mention the informative journey of my project that has been carried out during the internship period.

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# Chapter 1

## Introduction

### 1.1 Overview/Background of the Work

The internship report has been prepared as a requirement of the internship program for the partial fulfilment of the Computer Engineering program under the department of Computer Science and Engineering at Independent University, Bangladesh. The report will mainly focus on the knowledge gained during the experience in internship workplace environment. Additionally, the report also aims to reflect my main achievements, project works in details, and the professional growth gained in the journey. It will also discuss about:

- i. Training details
- ii. Responsibilities and tasks assigned
- iii. Organizational overview
- iv. Experiences of problem solving in the training
- v. Organizational work environment
- vi. Interpersonal skill developments

The report has been articulated aiming only for academic purposes and completing the industrial project requirement. To complete the report successfully, information has been gathered from both primary and secondary sources with the permission of my supervisor. The internship report describes my role and tasks as a trainee and provides specific details about the main tasks that were assigned. Finally, a conclusion has been drawn from my experiences and exposures to the project activities and teamwork related to it.

## 1.2 Objectives

The main objective of this internship to deliver advisory services to the farmers using innovative technology such as IoT sensors, remote sensing and machine learning solutions to measure and monitor key parameters and offer customized advisory for crop farming, and livestock dairy farming.

## 1.3 Scopes

IoT is a very rapidly growing field. The IoT career opportunities that currently exist could never be even imagined or thought of before. There are many fields, to choose from currently, and I can either go into security, design the UI, or design the various subsystems like sensors, embedded software. The choices presented before me are endless.

# Chapter 2

## Literature Review

### 2.1 Relationship with Undergraduate Studies

The growing demand for food in terms of quality and quantity has increased the need for industrialization and intensification in the agriculture field. Internet of Things (IoT) is a highly promising technology that is offering many innovative solutions to modernize the agriculture sector. Research institutions and scientific groups are continuously working to deliver solutions and products using IoT to address different domains of agriculture. There are lots of course that are related to this internship like

Algorithms

Numerical Methods

Database Management

Linear Algebra: Vectors and Matrices

### 2.2 Related works

This concept is still new in Bangladesh. But in other countries this kind of projects are used commonly for agriculture and farming.

The below mentioned web link is of a company in Brazil that gives different crop solutions using remote sensing.

<https://www.gamaya.com/>

CorpX is used in USA, Israel and New Zealand. They also give data driven solution using IoT.

<https://cropx.com/>

# Chapter 3

## Project Management & Financing

### 3.1 Work Breakdown Structure

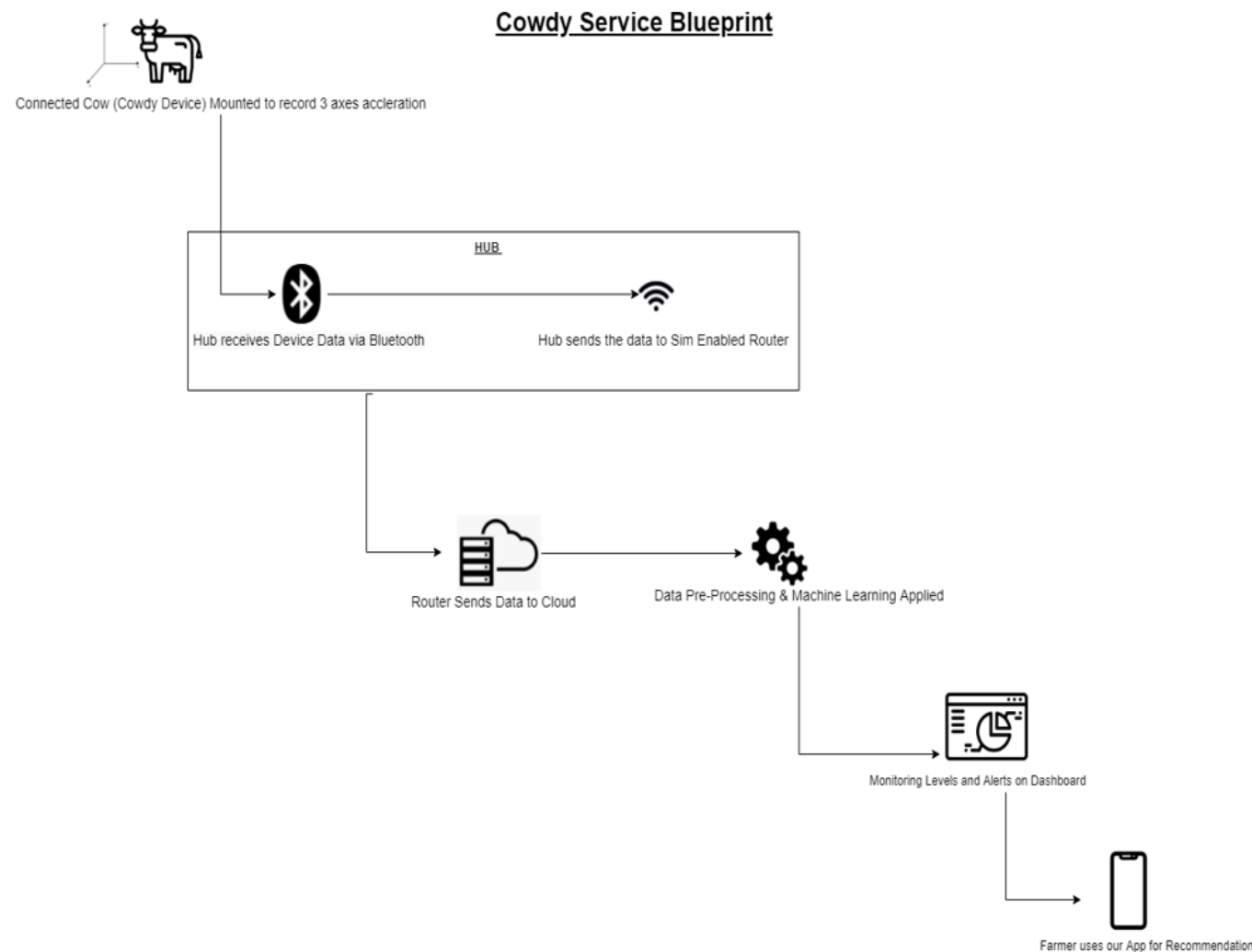


Fig: Cowdy Service Blueprint.

Cowdy monitors cows' health, activity and heat cycle in real-time, and provides timely

recommendations to the farm owners. This helps farm owners to save money and time and also increase their income.

## 3.2 Process

### Install the Cowdy Router

Our easy to install Cow router is completely solar powered and can be installed by anyone in just 20 minutes. It connects with all Cowdy devices within a 2 mile range and uses cellular connectivity to pass this information to our servers.

### Installation of Cowdy

Tie the strap on the cow's neck. The Cowdy device comes with a strap designed to comfortably fit around your cow and a small magic box that measures temperature, activity and cow behavior. The installation process is extremely easy and takes just a few minutes. As soon as that is done, Cowdy will start transmitting live data to your interactive dashboard.

### Monitoring and Notifications

The data sent by your cows undergoes our proprietary machine learning based algorithms to bring you the best actionable recommendations. You're prompted every time there is a health alert or your cow shows any disease symptoms or enters into heat or pregnancy

### 3.3 Gantt Chart

Technical Poc - Bucket						
	January 2022	February 2022	March 2022	April 2022	May 2022	June 2022
Recruitment	Job advertisement for field facilitator (with veterinary background) Hiring Vet					
Partnership		Implementation Partner Hardware Partner				
Procurement		Discussion with tech on procuring physical server Device deploy-ready and handed over to i-Farmer				
Field Operations			Daily check in with vet and farm staff (Phone call) Monthly farm visit (core team member)			
Training & Testing Algorithms				Optimizing and revising cowdy module functions Monthly final commit to module		
User Dashboard Development					Preparing a list of features for user dashboard Process flow plan for UX	

Fig: Table showing Time basis work

### 3.4 Estimated Costing

#### Resource Plan - Procurement

Item	Cost
3 Security cameras	50000
Server Laptop (to store video feed)	40000
30 IMUs	50400
5 hubs	40000
5 routers	25000
Broadband/SIM Internet	2000
Database Server (MySQL)(Note: Might need to switch to NoSQL database such as BigQuery)	17000
Procuring physical server to store Cowdy throughput data (if approved)	200000
<b>Total</b>	<b>424400</b>

Table: Resource Plan - Procurement

# Chapter 4

## Methodology

### Fitbit For Dairy Cattle

Cowdy monitors cows' health, activity and heat cycle in real-time, and provides timely recommendations to the farm owners. This helps farm owners to save money and time and also increase their income.

### Install the Cowdy Router

Our easy to install Cow router is completely solar powered and can be installed by anyone in just 20 minutes. It connects with all Cowdy devices within a 2 mile range and uses cellular connectivity to pass this information to our servers.

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# Chapter 5

## Body of the Project

### 5.1 Work Description

Cowdy is a smart collar for cows that tracks temperature, activity and monitors cow behavior to provide farmers with action-able text message alerts. Cowdy collars monitor dairy cows 24/7, 365 days a year. Cowdy gives notifications for heat detection, illness and stress to improve milk production and increase farm income. Cowdy collars are comfortable for cows to wear requires little to no maintenance.

Install Cowdy.

Cowdy can be installed by anyone in just 20 minutes. Cowdy uses cellular connectivity to pass information to our servers. We make sense of the data using machine learning dairy science and send notification to the farm using SMS or APP. No maintenance is required. Farmers or Farm owners can monitor cows anytime, anywhere.

Strap the Cowdy device.

Farmers have to tie the cowdy device using the belt on the cow's neck. It simply consists of a strap designed to comfortably fit around the cow and a small box that measure temperature, activity and cow behavior, i.e. whether it's eating, sleeping, ruminating or showing lameness.

Monitor your Cows.

Cowdy will start transmitting live data to an interactive dashboard. The dashboard shows cow's temperature activity readings over time through immersing graphs along with easy to understand insights and actionable recommendations that can be converted into tasks, for your ease. The dashboard can be used by large farmers and companies to push SMS to the small farmers or contract farmers suggesting the recommendation or actions to be taken based on the cows health data

Get alerts actionable Recommendations.

The data sent from the cows undergoes through machine learning algorithms where data gets combined with expert knowledge base and years of experience to bring the best actionable recommendations. Farmers are notified every time there is a health alert or the cow shows any disease symptoms or enters into heat or pregnancy

## 5.2 Requirement Analysis

Rich Picture

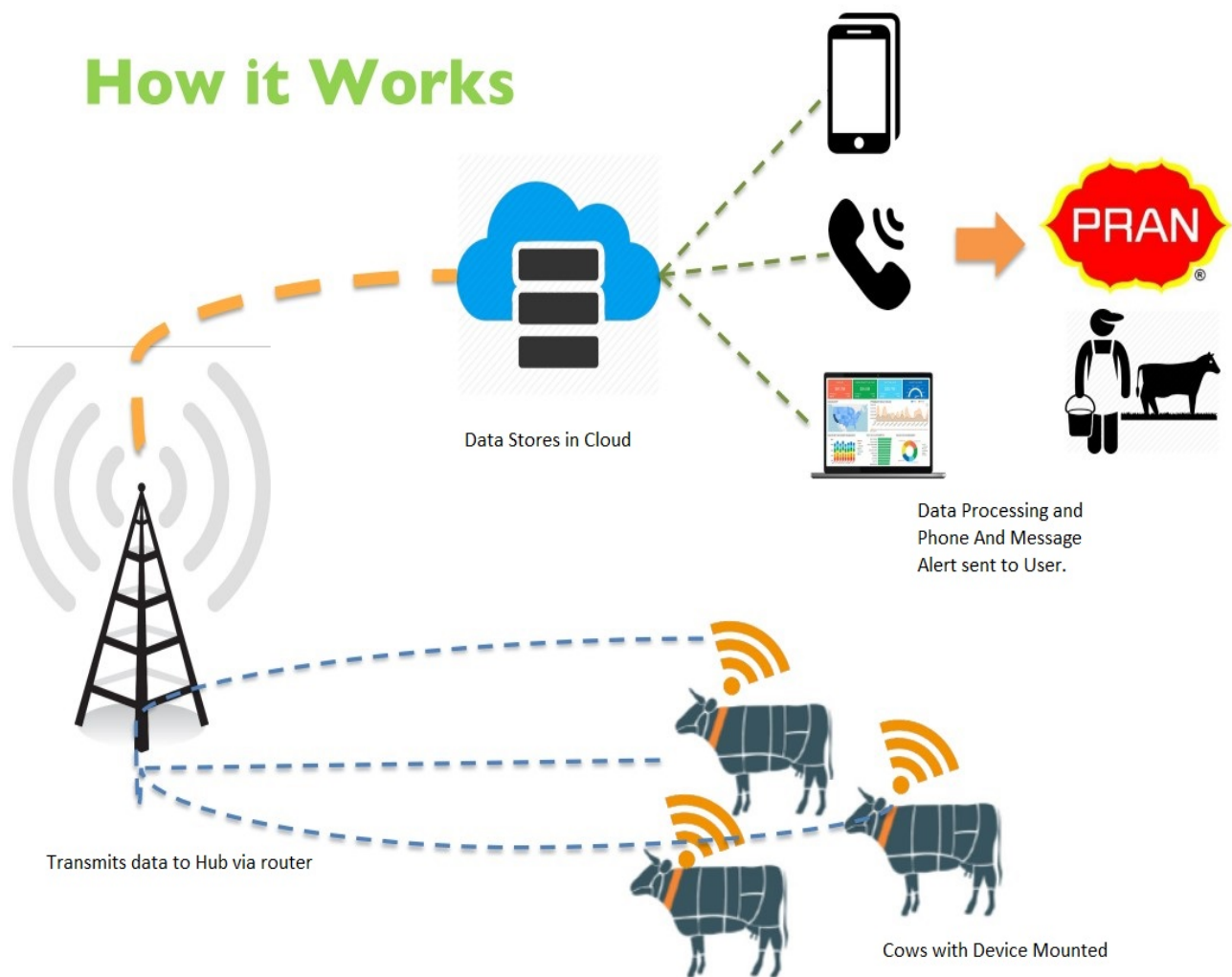


Fig: Cowdy process.

## 5.3 System Analysis

### 5.3.1 Cowdy Features

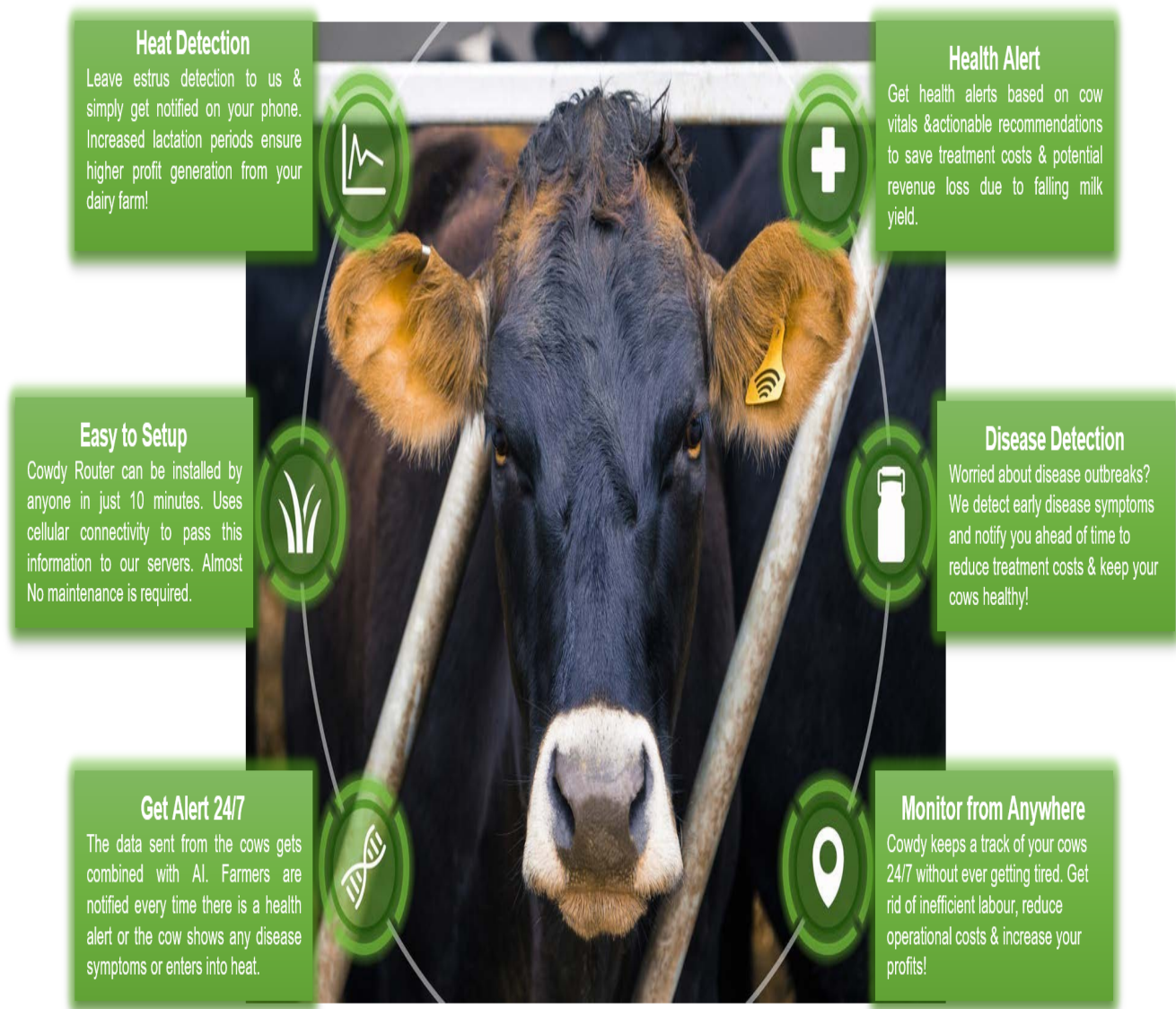


Fig: Cowdy Features.

#### Heat Detection

Leave estrus detection to us simply get notified on your phone. Increased lactation periods ensure higher profit generation from your dairy farm!

#### Easy to Setup

Cowdy Router can be installed by anyone in just 10 minutes. Uses cellular connectivity to pass this information to our servers. Almost No maintenance is required.

#### Health Alert

Get health alerts based on cow vitals actionable recommendations to save treatment costs potential revenue loss due to falling milk yield.

#### Disease Detection

Worried about disease outbreaks? We detect early disease symptoms and notify you ahead of time to reduce treatment costs keep your cows healthy!

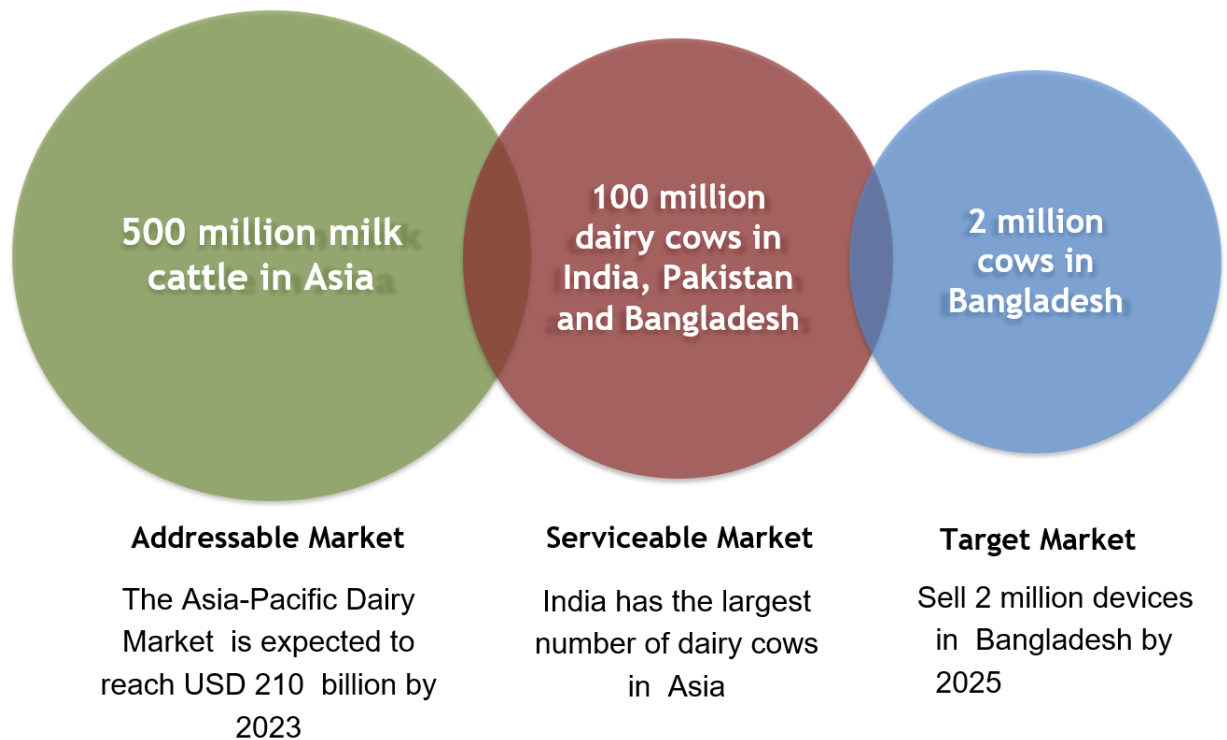
#### Monitor from Anywhere

Cowdy keeps a track of your cows 24/7 without ever getting tired. Get rid of inefficient labour, reduce operational costs increase your profits!

#### Get Alert 24/7

The data sent from the cows gets combined with AI. Farmers are notified every time there is a health alert or the cow shows any disease symptoms or enters into heat.

### 5.3.2 Market Analysis



### Business Model



Fig: Cowdy Market Opportunity.

### 5.3.3 Problem Solution Analysis

#### Problems in Livestock

One of the most important metrics for dairy farms is percentage of heifers cows that become pregnant during a breeding season. A cow can come in heat at 3 am, behavioral estrus lasts for a short duration. In order to perform manual checks, it would require making an observation every 15 minutes. It is difficult if not impossible to monitor cows using manual methods. Missing an estrus or 'heat' can delay breeding for 18-24 days, resulting in a loss of up-to 400 $\text{percow}$ .

Bangladesh produces 9.4 million tonnes of milk against the requirement of 15.04 million tonnes in a year. The lack of land availability, limited feed and fodder, and lower milk production efficiency are key constraints for increasing milk production.

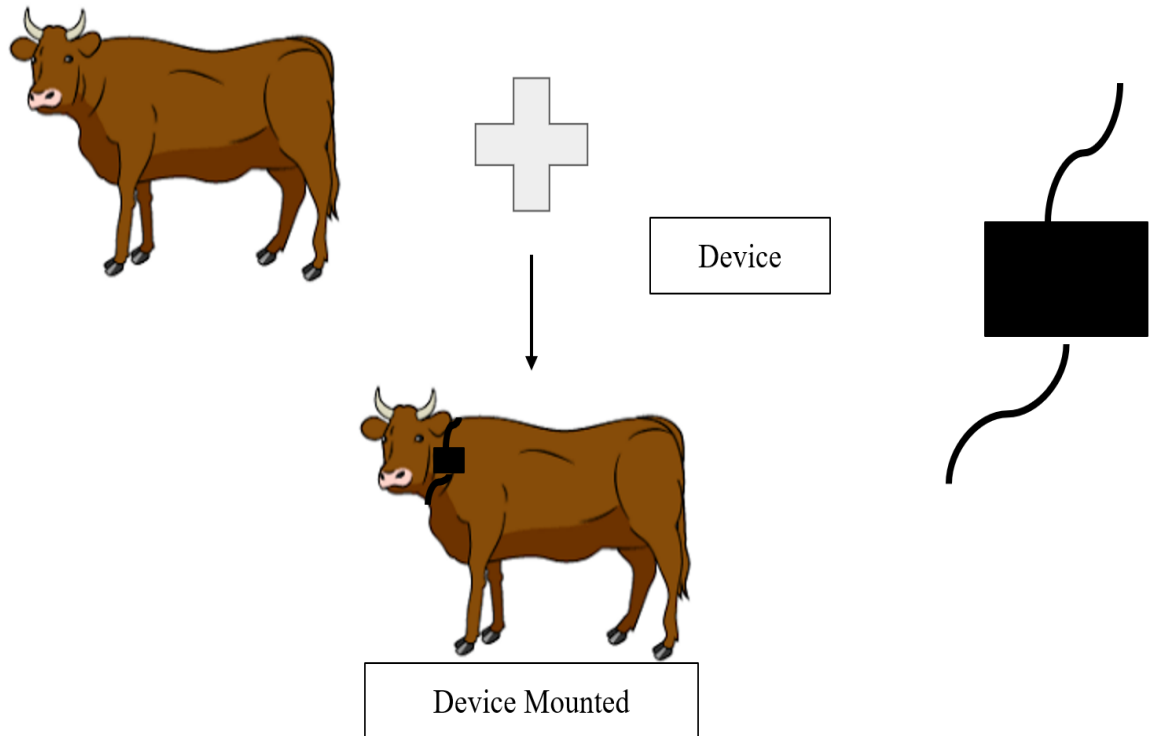
#### Our Solution Cowdy

Cowdy is a smart collar for cows that tracks temperature, activity and monitors cow behavior to provide farmers with action-able text message alerts. Cowdy collars monitor dairy cows 24/7, 365 days a year. Cowdy gives notifications for heat detection, illness and stress to improve milk production and increase farm income! Cowdy collars are comfortable for cows to wear requires little to no maintenance.

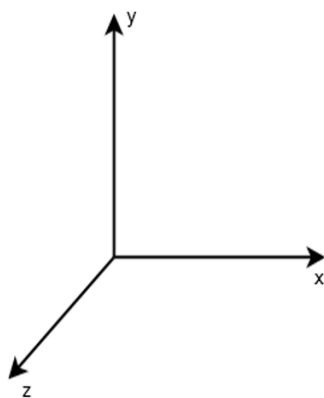
## 5.4 System Design

### How Cowdy Works

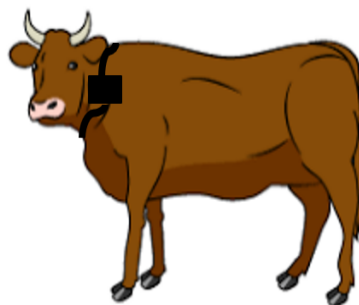
1. RFID Device being mounted



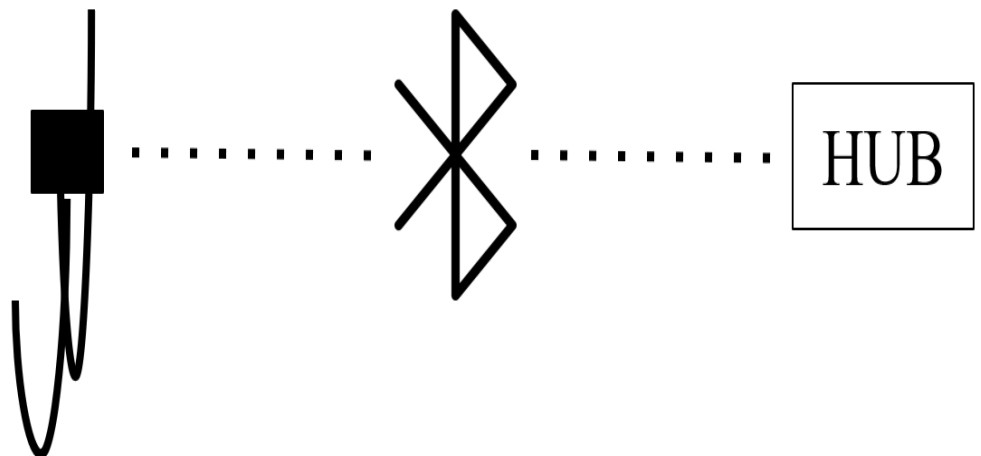
2. RFID Device (Tracks Accelerometric Movements)



The device collects the information of the movement of the cow in the x, y, z-axis, known as the 3 dimensions.



3. Transmits data to Hub via bluetooth protocol

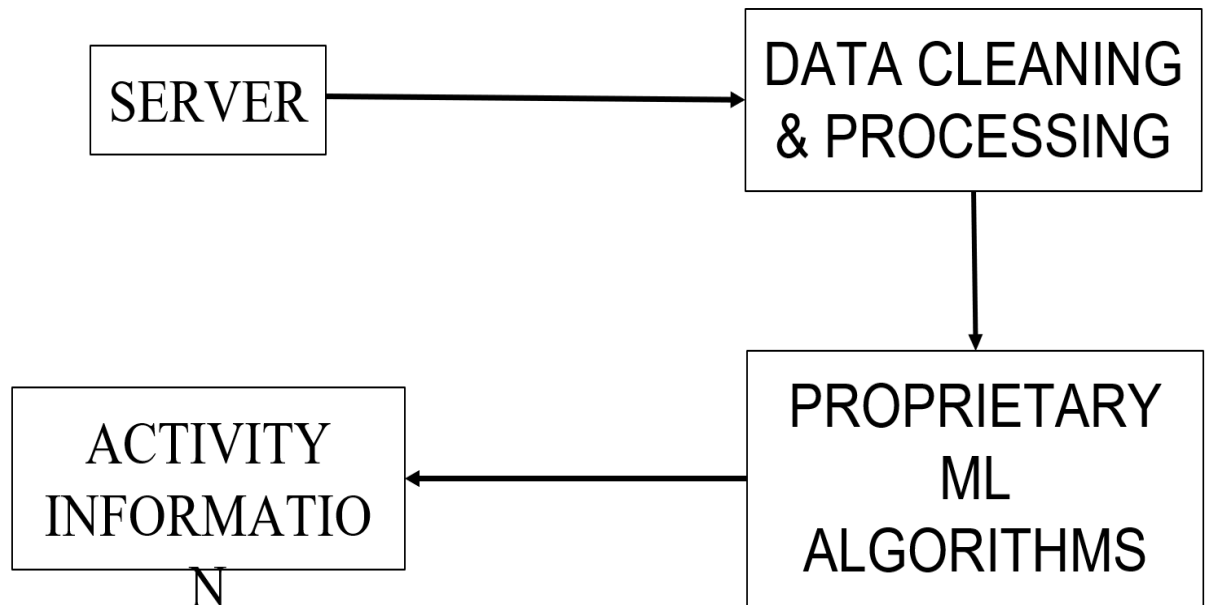


4. Transmits data from Hub to SIM powered Router which uploads the data to our server





5. In our server we:
- Process and clean the data
  - Push it through our proprietary machine learning algorithms
  - Generate activity information



6. We use this activity information to identify important events such as times when the:
- Animal might get sick
  - Animal is in estrus (or sexual heat)

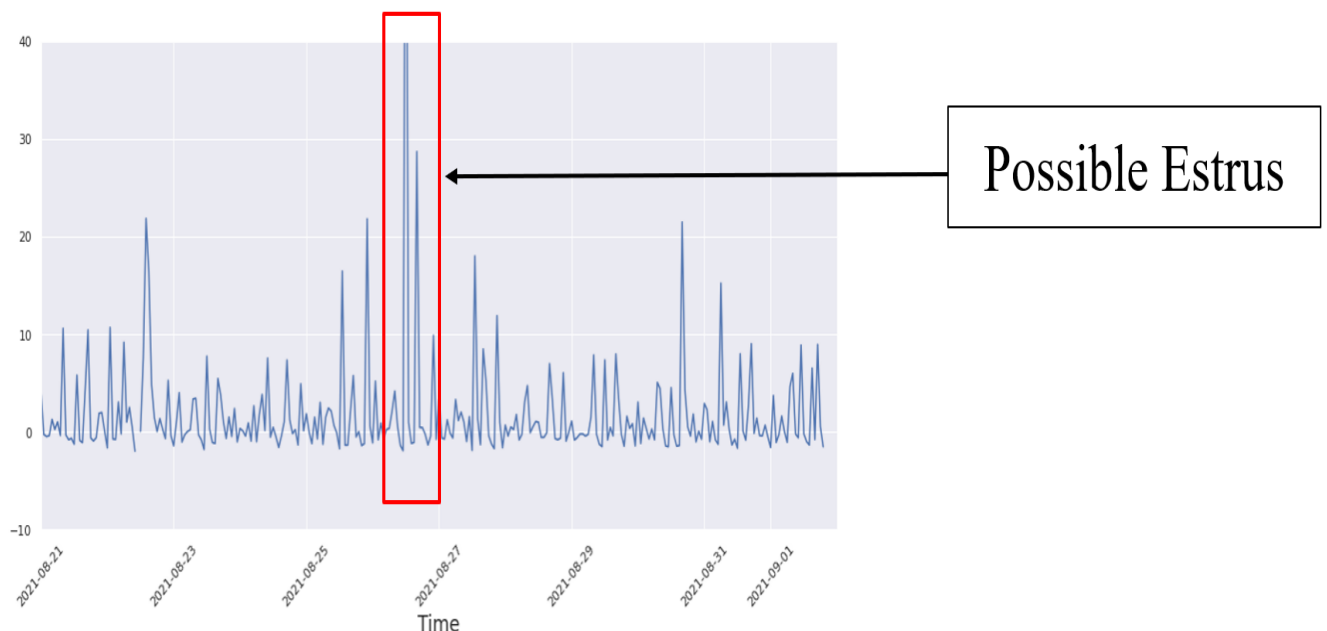


Fig: How Cowdy Works

## 5.5 Testing

### Input

To get the data from device we have to mount the Cowdy device on cow's neck.

### Output

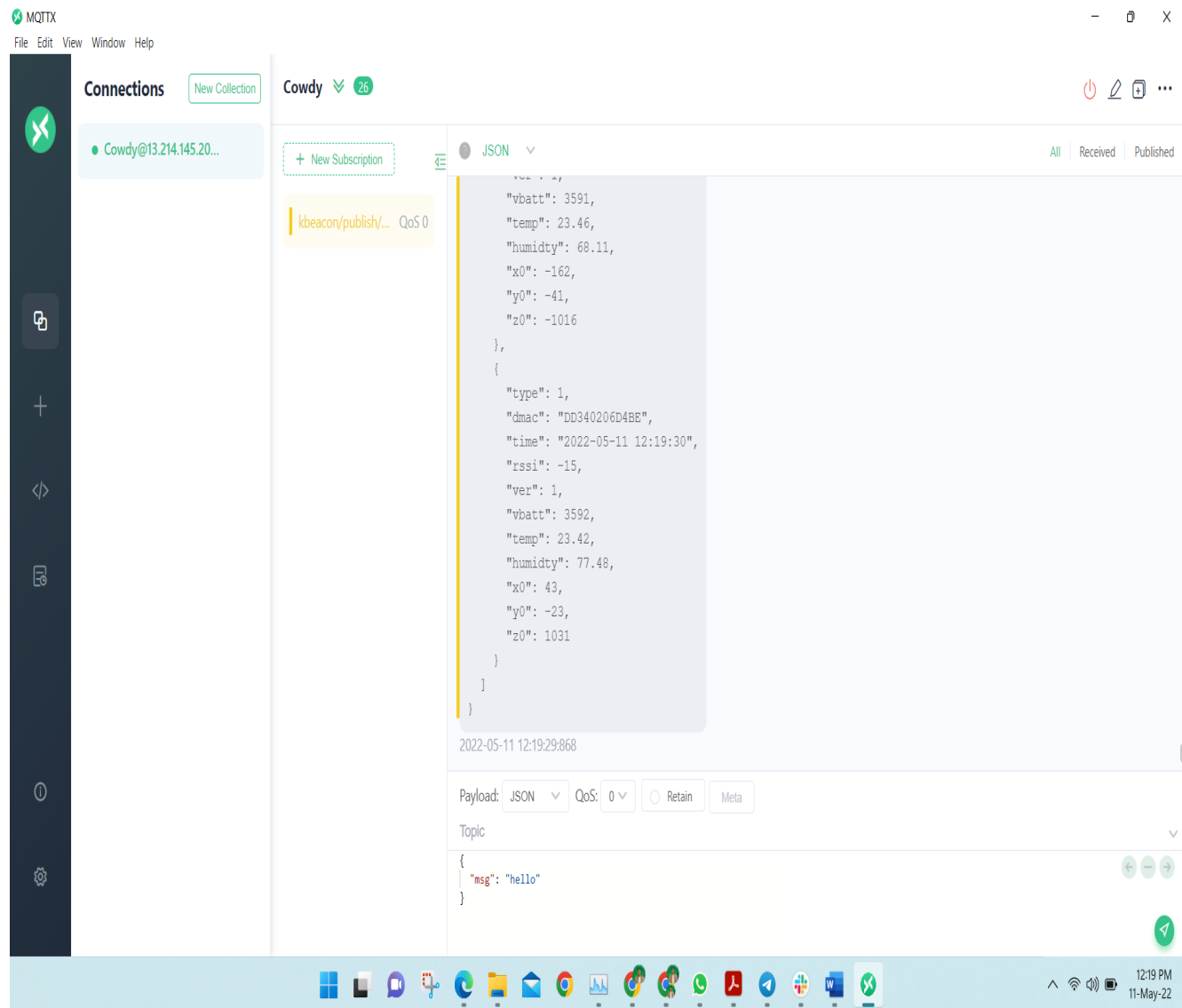


Fig: Cowdy Data from device

## Test Results

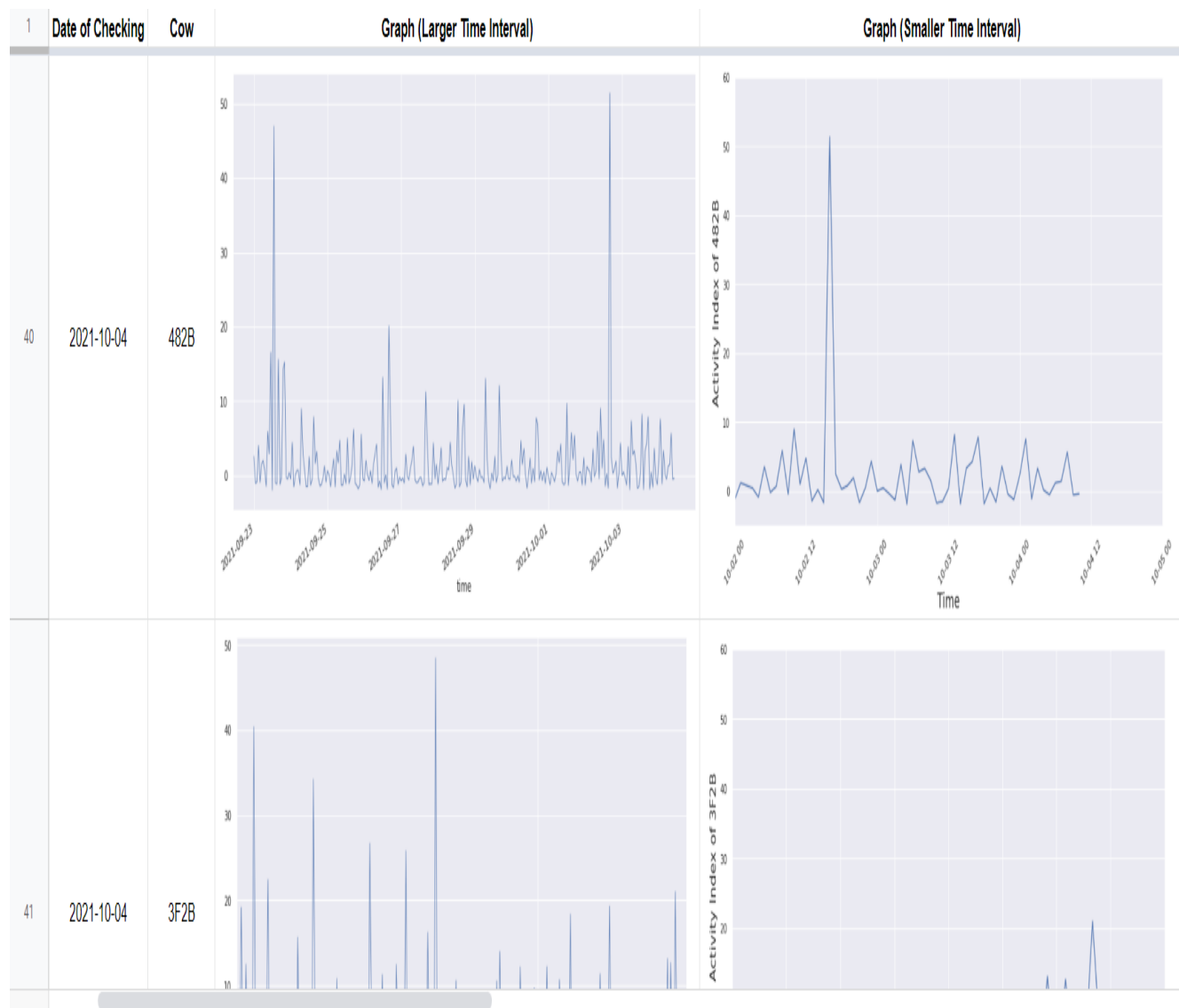


Fig: Graph showing data from Cowdy Device.

# Chapter 6

## Results & Analysis

Effective detection of estrus in cows has been widely studied in animal sciences. The high rates of detecting estrus can improve insemination results, and control calving interval and total pregnancy rate. Methods of detecting estrus include two major categories. One is the manual measuring, e.g., changes in body temperature, changes in vaginal mucus resistance, visual observations made by a skilled farmer and based on his/her intuition and experience. However, these approaches are labor-intensive, time consuming, costly and inaccurate operation when dealing with a number of animals. The other is automatic monitoring. Various sensor systems have been reported for the detection of key events of cows (e.g. estrus, illness or welfare). Cowdy uses the GPS, magnetometer and accelerometer to recognize the behaviors of cow.

The New Cowdy devices bought from Bondstein's Technologies are not mounted yet. The old device data had some complication. We have tested the previous devices were tested on 4 cows. The result we had were too much False Positive results. The mission was to make things easier for Farmers with too much false positive data which was not possible.

# Chapter 7

## Project as Engineering Problem Analysis

### 7.1 Sustainability of the Project/Work

One of the most important metrics for dairy farms is percentage of heifers cows that become pregnant during a breeding season. A cow can come in heat at 3 am, behavioral estrus lasts for a short duration. In order to perform manual checks, it would require making an observation every 15 minutes. It is difficult if not impossible to monitor cows using manual methods. Missing an estrus or 'heat' can delay breeding for 18-24 days, resulting in a loss of up to 400*percow*.

Bangladesh produces 9.4 million tons of milk against the requirement of 15.04 million tons in a year. The lack of land availability, limited feed and fodder, and lower milk production efficiency are key constraints for increasing milk production. We can say that this project will help many farmers as Bangladesh and many other countries depends on livestock Farming.

# Chapter 8

## Lesson Learned

### 8.1 Problems Faced During this Period

Main problem we faced during this active project is that a project must have a dedicated team for the project where the team members will work and give all their attention on the project.

Cows with device are always moving away from router which leaves a gap on data receiving.

### 8.2 Solution of those Problems

The first problem has a easy solution that is to hire a dedicated team, which not done yet.

The second problem can be reduced if the people working in the farm has idea and knowledge about the device and how it will help them.

# Chapter 9

## Future Work & Conclusion

### 9.1 Future Works

For future we can increase the number of cows per Router which will help if one Farm has more than four cows.

We can add more features with the existing ones.

### 9.2 Conclusion

Effective detection of estrus in cows has been widely studied in animal sciences. The high rates of detecting estrus can improve insemination results, and control calving interval and total pregnancy rate. Methods of detecting estrus include two major categories. One is the manual measuring, e.g., changes in body temperature, changes in vaginal mucus resistance, visual observations made by a skilled farmer and based on his/her intuition and experience. However, these approaches are labor-intensive, time consuming, costly and inaccurate operation when dealing with a number of animals. The other is automatic monitoring. Various sensor systems have been reported for the detection of key events of cows (e.g., estrus, illness or welfare). Cowdy uses cows' activity index to detect estrus. The k means cluster is used to investigate the statistical acceleration variation and establish the training set online, which makes it possible to adapt to individual activity of cows.

# Bibliography

Estrus Detection in Dairy Cows from Acceleration Data using Self-learning Classification Models.

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