

Nepal Project: RFID tags

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RFID tags are used all over the world, from surveillance applications to tracking animals, casino chips, even airport baggage (Filippin 2013). Many stores are introducing the concept of RFID tags especially into their warehouses. This allows them the ability to track how much of a certain product they have as well as the whereabouts of that product (Government of Canada 2009). Even libraries are taking advantage of this and have placed tags in their books for the purpose of security but also making it easier for a customer looking for a specific book (Emmett and Kern 2003). This idea of identifying objects from great distances has been around for a very long time (Poole n.d.).

Many believe that RFID was introduced and used during World War II to identify between allies and enemies (Rieback *et al.*2006). They called this system IFF (Identification Friend or Foe). IFF used interrogation systems that would transmit a specific code to an oncoming airplane or ship and if there was a proper reply, the base knew that it was a friendly machine, but if there was no reply or if there was an incorrect reply, there was the possibility of it being an enemy (Poole n.d.). Sir Robert Watson-Watt was one of the first ones to experiment with the transmission of data wirelessly (Poole n.d.). He used a transmitter to send a high power signal to/at an aircraft. The signal would then bounce off the aircraft back to the receiver (Poole n.d.). This process only worked to show if there was an object in the area but could not identify what/who the object was (Poole n.d.). Over the years the technology of RFID expanded and now it is used very frequently especially in tracking animals like cattle or used in dairy farms.

Agriculture in Nepal is very different from places like Canada and the United States. But that doesn't mean that it is worse. There are three different regions in Nepal, the terai, the hill region and the mountain region (Nepal Agriculture 2105). All three of these areas require different forms of farming. One form of farming in Nepal is dairy farming. This type of

agriculture is mainly done in the terai region (Hayashi *et al.* 2005). Buffalo is a very common form of dairy farming in Nepal in fact out of the 1.2 million metric tons of milk produced by small scale farmers in 2003 in Nepal, 65% of it was from buffalo and only 28% was from cows (Hayashi *et al.* 2005). In Nepal there are about 3.7 million buffalo and 7.0 million cattle being raised, but there is a problem with the amount of land available for these animals (Hayashi *et al.* 2005). Introducing RFID tags will help manage these farms and possibly even allow them to expand. In Nepal many of the animals aren't being fed enough and this is because of the amount of land that is being sucked dry of nutrients and minerals (Nepal Agriculture 2105). Also much of the land in Nepal is either hilly or mountainous which is extremely hard to farm on, and terracing is very laborious. It doesn't help that the flat areas of the country (the terai) only makes about 14% of all the land. So feeding their cattle and buffalo becomes very hard (Hayashi *et al.* 2005). By introducing RFID tags it will help manage these farms and possibly even allow them to expand their farms.

RFID stands for radio-frequency identification; this device is made for short-range radio technology (Landt 2005). It was built mainly for the use between an unmovable object and an object that moves, so in this case a between the tag on a cow or buffalo and the reader (Landt 2005). The reader is a device that sends a signal to the tag and collects the response (Landt 2005). It uses an electromagnetic field to transmit data wirelessly to the tag once the tag picks up that signal the tag will then relay the information collected on it back to the reader (Technovelgy n.d.). These tags are also known as transceivers or transponders because of their ability to send and receive data wirelessly. They are built with a memory that can store up to one thousand bytes of data (McDowell 2009). This data varies, but it is commonly just a number,

kind of like a license plate, the number allows the reader to be able tell all the tags apart (McDowell 2009).

The most important part of an RFID system is the reader. The tags are activated by the reader; these readers also are the destination of the data transmitted by the tags (McDowell 2009). They are devices that connect the tags to the system/computer. Just like the tags the reader uses an antenna to collect the data being transmitted; it then decodes the signals and sends it to a computer for processing (Technovelgy n.d.). The way that this data is passed back and forth is through electromagnetic waves, an antenna takes electrical current and converts it into electromagnetic waves which go through the air to another antenna which takes the waves and converts it back into electrical current (Want 2006). It is through this process that RFID readers are able to transmit data as well as track the tags.

There are two kinds of RFID tags the first is an Active RFID tag (Want 2006). These tags are quite different than the other type, it is made in such a way that it has its own power source built into it(Want 2006). Now the reason for this having its own power source is so that it can be activated and read a greater distance away (Technovelgy n.d.). They function pretty much the same way as the other tags, a signal is sent from the reader and it will hit the antennae on this tag (Want 2006). This then activates the tag and because it has its own power source, the tag will send a response back within milliseconds (Technovelgy n.d.). It does this in a very precise way. When the signal hits the tag, the tag jumps to life; the battery starts up and begins immediately sending out radio waves, all the data that is on the tag will be sent through the air via those radio waves (McDowell 2009). The reader will then pick up those waves and translate them from the binary code they are in into English or a code that is understandable (McDowell 2009). These active tags however do have negative aspects. For instance they have their own power source

making them bigger, because it needs a battery attached to it, this makes the active tags harder to attach to an animal and more likely to be broken off (Shukla *et al.* 2011) (Want 2006). Also the active RFID tags are more expensive to make as well as to transport (Shukla *et al.* 2011).

Another problem with the active tags is that the battery eventually will die, meaning that you will have to replace them every so often, which can get very expensive very fast (Shukla *et al.* 2011).

But on the positive side, with its own power source it can be as far as 300 feet away from the transceiver and still be able to transmit its data (Shukla *et al.* 2011).

The other type of RFID tag is the passive tag. These tags do not have their own power source and because of that cannot be activated a large distance away; they have to be closer to the reader because the reader is its means of power (Want 2006). It is able to be its power because when the reader sends out its signal the waves from the signal get picked up by the antennae and go up and down, oscillating (Want 2006). Because of this oscillation the coils of wire in the transceiver conduct a current which then is used to send the data back to the reader (Want 2006). This oscillation of the waves is the same concept used in microphones, where the sound waves hit a “magnet” which then moves up and down causing a current, turning the sound waves then into electrical waves, making it so much easier to transport sound. Once there is a current in the tag, it activates all the circuits and causes the data to be transmitted (Want 2006). There are negative aspects to this type of tag as well, for instance the fact that it has to be within a couple of feet from the reader in order to work, this really minimizes the efficiency of the process but allows the farmer to do a quick physical checkup on the cow as it passes by (Shukla *et al.* 2011). The passive tag is more suited for the people in Nepal; it is smaller, easier to handle, less expensive and can be thrown out when it is no longer needed (Shukla *et al.* 2011). All these aspects of the passive tag make it so much better for the Nepalese people.

These tags are used in many different areas and the data stored on the tags as mentioned before almost always will there be a number, like a license plate, that distinguishes the tag from the others (Want 2006). With that number the reader is able to locate individually where that object is and also then separate it from the others. This separation comes in very handy when dealing with vaccinations, and making sure that all the animals are vaccinated and also that one animal isn't vaccinated twice (Want 2006). There are other uses for the feature of separation that the tag gives, for instance on the computer the farmer can write down notes about each animal for instance, lactation period, and whether it is in heat or not (when it will be in heat roughly), also things like how old the animal is (Electro-com 2013). All these things will help out the farmer and allow him to manage it all. Another thing that the tags help with is anti-theft, this is more for larger farms, but it will show you which animal is missing and also maybe in the future when the technology is advanced where the animal is (Electro-com 2013). There are companies working on actually holding information on the tag itself, like actual information. But at the moment there aren't any out and if there are they would be too expensive for the people of Nepal (Henrici *et al.* 2010). There are different ideas as to how to get the information on the tags and what kind of information will be on the tags, but right now it is all just speculations and theories that are being tried out in labs and such but are not available in mass quantities (Henrici *et al.* 2010).

In Nepal there are many dairy farms, most of them are not that big but with the technology of RFID, it will allow the farmers to grow their farms with the assurance of it being well maintained. These tags are mostly targeted for the farm with about 20 or more cows or buffalo (Hayashi *et al.* 2005). The reason being, with only one or two animals it is really easy to remember who is who. Statistics show that the average amount of dairy cows and buffalo in

Nepal is rising each year by about 1.8% (Hayashi *et al.* 2005). This statistic shows that by introducing these tags into Nepal now, as the amount of dairy animals increase the farmers will be able to control and look after all the animals together (Hayashi *et al.* 2005).

These tags can be purchased in Nepal not just by one person but by a community or a town, they could come together and purchase a reader all together and share the machine amongst each other, especially if they can't afford one individually. Each animal would then get its own tag but the town would share the reader, once a day they could walk all their animals past the reader allowing it to collect the data, about their health etc. but mainly just to record the data of the day; the temperature of the animal, the health, if it was vaccinated, the age, if it is in heat, all that information could be collected (Electro-com 2013). It doesn't have to be daily but the more often the better. Another thing that these tags could do was allow the farmer to track down how much grain each cow received. For example, if a farmer had three cows and every day he would give them all some grain, the farmer would expect that they all ate the same amount. But cows have personalities and there are hierarchies in a herd as well as habits that they start to develop. So if one animal eats half of the feed and leaves the last half for the other two cows that would end up as a problem for the farmer seeing how two of the cows aren't getting enough feed. But if those three cows had RFID tags on and the farmer went and fed one of the cows exactly the same as the next and it was recorded through the RFID program then that would save a lot of money and resources for the farmer (Electro-com 2013). By sharing the reader it would also allow the farmers to gain trust in the community and encourage strong attitudes towards working in a group.

By giving these tags to Nepal it will allow them to control their farm in a way that they are not used to. There are however companies in Nepal that make RFID tags but they do not use

them in animal control (Rfid companies in Nepal 2015). All they would need is a few tags, a reader and some type of computer and the farmers in Nepal can manage their farm and possibly even grow. If every cow and buffalo in Nepal had a passive RFID tag attached to them it would open a whole new world to Nepal for export of their meat. Because of the religions in Nepal they are not allowed to eat beef, but if they would raise cattle and export the cattle it would generate jobs for many people (Nepalese Food Culture 2011). If this ever did happen and the Nepalese people started exporting beef there would be another area where Nepal could get money. If all the animals had a tag on them, the customers looking to buy the animals would be able to tell which ones were vaccinated for example, or which one caused an outbreak in a certain virus. This idea is used everywhere in Canada to keep customers happy. Almost all the cattle in Canada, especially if they are being raised to export to different countries, are tagged with a passive RFID tag as they leave the farm (Animal Identification n.d.). By doing this it allows farmers to export their cattle a lot easier seeing as the tag will show whether or not the animal is sick (Animal Identification n.d.). Another great reason for having the RFID tag on the cattle is because when there is a outbreak of a virus farmers are able to track it to which cow is ground zero for that virus (Livestock Management RFID 2015). All they have to do is look at all the animals infected and then track their paths back to which animal had it first (Livestock Management RFID 2015). This then allows farmers to keep track of the animal's health as well as track those that are sick (Livestock Management RFID 2015).

The process of manufacturing these tags and readers isn't that hard seeing as most of the process is automated (Swamy and Sarma 2003). The first thing that has to happen is the design of the antenna has to be engineered (Swamy and Sarma 2003). Each company has different ways of making the antenna, different trademarks and special features, but all this is but together and

thought up in an engineering department (Swamy and Sarma 2003). Once a design is finished, and all the wires and codes are drawn out the design will be submitted into a special computer (Swamy and Sarma 2003). This computer then will take that sketch of the design and draw it to scale, it is then tested for performance, and adjustments are made to maximize this performance (Swamy and Sarma 2003). Once the design has been made, they change small details on the antenna and “print” off these designs ready to be tested (Swamy and Sarma 2003). The process of printing these designs off includes certain metals, this is because of the antenna, it needs to be able to generate its own charge, also the metal is used to store the data (Swamy and Sarma 2003). The antenna is most commonly made out of aluminum because it is quite cheap, however different metals are used but it increases the overall price of the tag (Swamy and Sarma 2003). The chips look like little dots on the final product; this is because they don’t have to be big to be able to store data (Swamy and Sarma 2003). They are normally made out copper. The antennae are then added to a chip and are tested again; the antennae and chips that perform the best are put into production (Swamy and Sarma 2003). This process goes extremely fast and the antennae and chips are made in the millions around the world each day (Swamy and Sarma 2003). Also the production of the antennae and chips are quite cheap, ranging anywhere from less than one cent to more than 10 cents depending on the metal used (Swamy and Sarma 2003). However a farmer can’t use this product the way that is, so to make it durable for on animals and for in different climates, the company will coat the chip and antenna in plastic (CCIA 2009). Its normally a heavy duty plastic that will not deteriorate easily and is strong enough to be punched through an animals ear (CCIA 2009). Companies are having problems with the susceptibility to weather however, and many are working on ways to either keep the chip as well as the antenna dry, or to make them resilient to drastic conditions. By adding the plastic it does boost the price

of the tag but it is very unlikely that it will cost more the fifty cents; most passive tags cost around five cents.

The equipment needed to make the tags, to attach the chips to the antennae, to print off the antennae etc. varies a lot depending on the people running the company, the size of the company and the tags that are being made. The printers can reach prices of 50,000 dollars or more and that's just one piece of the puzzle and the computers needed to draw the designs can cost up to 2000 dollars (AutoCAD n.d.). To know exactly how much all the equipment is going to cost would be very difficult, because it depends on the size of the operation but getting started now as an RFID manufacturer would be very difficult because of all the competition.

In Canada there is a company called RFID Canada and this company is a manufacturer of RFID tags (RFID Canada n.d.). They make them with the purpose of tracking animals, however their work is not used on the farm but mainly just for wild animals and making sure those animals don't die. They also use the tags to follow the animals, with the purpose of learning more about them in their natural habitat (RFID Canada n.d.). There isn't any difference between tags used for wild animals and the tags used on a farm other than the range that it can be tracked. RFID Canada can very easily start producing tags to be sold here in Canada for the cattle industry, however because of competition there is no demand for the tags here (RFID Canada n.d.). However if they would start producing them for in Nepal then there would be a demand and RFID Canada would get more business, thus creating more jobs and helping out with the Canadian people. Another thing that would benefit Canada by sending the tags from here to Nepal is that it could generate small businesses in Canada, not necessarily for manufacturing but for distribution. It is quite common for a small business to develop merely based off of distribution. This business could buy tags from the United States or anywhere else and then sell

them to Nepal. The benefit to the larger manufacturer being that they don't have to worry about the shipping and the details of selling to many different costumers (Small Business/Large Business Relationships 2015). If this idea were to happen it would generate a lot more jobs as well as make the Canadian economy stronger, obviously not by a lot, but every bit helps (Small Business/Large Business Relationships 2015). In order to get these tags to Nepal it wouldn't be hard seeing as they all are so small, it could very easily be transported via airplane. Depending on where the company is in Canada, the tags would fly from an airport around that area to one of the major cities in Nepal, like Kathmandu. Once in Nepal there will have to be distributors there, ready to sell the tags to the farmers in Nepal. It will be hard to sell the products to the people via telephone and TV commercials so in order to get the word out farmers will be aloud to sing up for a trial. This then allows the tags to start being spread by word of mouth and everyone will be able to see how amazing these tags are and how much the help the farm.

As mentioned above Nepal does have RFID manufacturing plants however they are not being used for animal tracking (Rfid companies in Nepal 2015). Once the tags are sold to Nepal by Canada as is a success among the farmers, then those companies could expand and focus also on making the tags for the farmers. By expanding the factories it would create more jobs for the Nepalese people and would help the economy there. Instead of having to import the tags from Canada or a different country Nepalese people could make their own and sell it to their farmers. It is beneficial for everyone involved.

In conclusion by sending these tags to Nepal where they have an ever growing population of cattle and buffalo, it will help maintain and manage all the farms there. With the help of these tags the people from Nepal will have a more controlled dairy sector, and also will save money because of the efficiency in feeding the animals, as well as the efficiency in vaccinating the

animals. Once this product has been introduced into the farms of Nepal the lives of those farmers will become a lot easier but also it will increase the profits in their farm.

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