Kitchen Initiative Jan9

Draft Version, dated January 9, 2023

Initiative: Innovation in Kitchen

Epic: Wet Grinding
Epic: Dry Grinding
Epic: Onion, Garlic, Ginger
Epic: Vegetable pre-processor

Faculty Empowerment Programme

The Faculty Empowerment Programme aims to provide a platform to comprehend the concept of IoT (Internet of Things) and its applications through interactive sessions and hands-on experience. The FEP opens up an avenue to the faculty members from University Departments, Regional Campuses, Constituent Colleges, Government Colleges and Engineering Institutes affiliated to Anna University to augment their subject expertise in the field of IoT.

The topics to be covered include:

- IoT Architecture
- IoT Protocols
- Communication Modules of IoT
- Cloud Computing
- Big Data Analytics
- Wireless Networks
- Embedded Systems
- Python Programming
- IoT System Design
- Raspberry Pi for IoT Applications
- LoRa for IoT Applications
- IoT Business Models
- Arduino and Raspberry Pi Interface

“How did they collect data before the IoT?”

“What kind of data?”

“About bird migration?”

“At Vedanthangal, they used to tie ribbons at the feet of birds.”

“Next year, the scientists will be looking for the birds with the ribbon.”

“That would give them an idea about how many birds return this year.”

“Yes. But they cannot find out their origin and movement.”

“Then, the scientists attach RFID tags at the feet of birds.”

“At various places they need to have RFID receivers to sense the tags.”

“Yes. RFID receivers collect info; someone needs to gather all this information.”

“With IoT, devices, communication and cloud all are available.”

Below is a chapter from the book, Web On-The-Go, published in 2009. It highlights the life before IoT. They built expensive proprietary hardware, communication protocols and software. Mostly data acquisition and very less control.

NATURE

In this story, we see how Web on-the-go technology helps combat global warming and other ecological problems.

Summer vacation had rolled around again. The family piled in the car and headed to Yosemite National Park. They decided they would camp at the campground, and so they packed their tents and sleeping bags. Late one evening, the family found themselves sitting around their campfire roasting marshmallows for s'mores, and talking. Each person shared their ideas on using Web on-the-go technology for topics relating to nature. Nancy told the family what she had discovered on her MID (Mobile Internet Devices) about tracking birds and whales. Jonathan shared what he had found about real-time information on fish harvesting. Jerry told the family how MIDs could be used as a large natural disaster warning system (for example, to warn of a tsunami), and Julia spoke of the issue that was most important to her: global warming. After finishing off two s'mores, Nancy began to talk.

"We have been learning about animal migration patterns in school," Nancy began, "and what interested me most was how we have learned to track the migration of birds."

The family settled in to listen. Jerry and Julia were so proud of Nancy and Jonathan for their curiosity and interest in new subjects.

"We've all heard of the Audubon Society," continued Nancy,

"but I had never really known the history of this organization till we learned about it in school. So, in 1803, a man named John James Audubon, a naturalist from America, began wondering about bird migration. He was curious as to whether or not a single bird would return to the same place each year. He decided to figure it out, by tying a small string around a bird's leg before it flew south. The following spring, Audubon saw the same bird with a string around its leg in the same place he had seen it before. So he knew that birds returned to the same place each year."

"But the cool thing is," Nancy continued, "scientists have found a much more effective way of tracking animals. They tag them with small tags that are electronic and give off repeating signals that are picked up by satellite radio devices. Obviously, this means that the scientists have a steady stream of data coming in from a tagged animal, without ever having to catch the same animal twice. But these electronic tags come with limitations, too. They are really expensive, and a bit heavier than a non-electronic tag, which some people think might slow birds down."

“I had no idea they were doing that,” said Julia. “Go on.”

“So,” continued Nancy, “two separate devices are needed to track an animal: a transmitter, attached to the animal, sends out radio waves just like any radio station. Then a receiver is needed to pick up the signal. This receiver is usually in a truck or an airplane, because scientists must follow the animal in order to keep track of the signal. The receiver can also be put in satellites that are orbiting the Earth. Scientists use networks of these satellites to track animals. The signals from all the satellites work together to figure out exactly where an animal might be. They can also watch the animal move and thus see its path. This type of tracking, using satellites instead of trucks, is really great because people don’t have to follow the animals wherever they go. Using satellites, scientists have tracked migration patterns of caribou, sea turtles, whales, seals, elephants, bald eagles, and ospreys.”

“Since they’ve begun using this electronic tracking system, scientists have gained a much more accurate picture of migration patterns. One interesting example of this is when scientists electronically tracked a herd of caribou. In doing so, they learned that the herd moves way more than they had thought, and that they return each year to the exact same spot to give birth. Scientists couldn’t have figured this stuff out without the electronic tags.”

“Another cool example of how important this tracking system is involves manatees. Manatees are an endangered species and scientists are trying really hard to protect them. Using radio tracking, we’ve learned that manatees have traveled as far north as Rhode Island during their migration, which means we must protect the entire Eastern seaboard in order to protect them, whereas before, protection efforts were limited to the Florida coast. So this tool can be really helpful in helping endangered species.”

“Wow,” said Jerry, “that’s so cool!”

“There’s more,” said Nancy. “The same technology that we are using to track animals could really help the people whose work or recreation somehow is affecting these animals. The example we learned about in school involved salmon. A little further north than where we live on the Peninsula, there are protected areas where the salmon run up the creeks. Over the years, park officials have noticed a decline in the numbers of salmon, so they decided to ban any fishing in any waterway in the park throughout the winter and spring when the salmon are swimming upstream to spawn, and any boating on the rivers. However, if they had more detailed migration information, officials might have more options. It could be that they can

decrease the amount of time the ban is in effect, or limit the bans to the exact places in the rivers and streams where the salmon run, instead of the whole park."

"But the coolest thing," continued Nancy, "is that even this electronic tagging system is getting much better these days. Now, with Web on-the-go technology, tracking birds, whales, and other animals is way easier. Instead of heavy electronic tags that might slow small animals down, scientists are now able to attach a mini-MID that is lightweight and solar-powered. They are able to cut down on many of the features from the MID, such as the screen, keyboard, and camera, and build a mini-MID."

"So now scientists can program these devices with an animal identification code, and the frequency with which data should be sent to the Website and address of the web server. The device then sends the animal identification code, current GPS location, and the current date and time to the Web sites at the programmed intervals. The migration data is captured and stored on the Website automatically. There is no need for either manual or satellite tracking. The mini-MID attached to the animal reports its location to the Websites automatically. This frees the scientists up to analyze this data and work on the more important aspects of species conservation."

"Before this technology, scientists needed to follow the tagged animal in order to collect current data and often simply lost track of them. With the new Web on-the-go technology, the device sends the data automatically and tracking has become much easier and much more convenient. Now scientists can work comfortably with this new information and predict the animals' behavior much more accurately."

"And lastly," said Nancy, "we can use this device for domestic animals, too. People can attach this mini-MID to their pet's collar, and track it using this device. There would really be no way for the pet to be lost ever again."

"Nice," said Jonathan. "Maybe we should get something like that for Snowflake."

"Well," said Jonathan, "I have a similar kind of story. In biology class we've been learning about how the fish populations in the oceans are diminishing. They say that 90 percent of the big predator fish are now gone from the oceans, due to overfishing. Isn't that scary?"

Everyone nodded their heads.

"We learned that fish make up about seven percent of the world's total food supply, and in developing countries, this number is much greater. Our teacher said that nearly half a billion

people earn their livelihoods from fishing or harvesting the oceans. You can imagine, however, that these people are having a very tough time locating and catching the fish as fish stocks dwindle and move further offshore. This makes the job of a fisherman difficult, as he has to travel further and come home with less."

"So there are many things that must be addressed," continued Jonathan. "We need to make sure that we don't completely overfish the oceans, while at the same time, make sure that people are still being fed and able to earn a living."

Many countries have decided that it is important to identify the places where fish actually are, in order to locate fish stocks and allow fishermen to catch more. India is a good example of this.

Over the past ten years, India has developed a system of helping fishermen locate fish. Using oceanic features such as temperature fronts, meanders, eddies, rings, and upwelling areas, they have been able to locate the sites where fish will most likely congregate; then these places are identified using satellite imagery. This has helped the fishermen out a great deal.

These oceanographic features can be mapped in near-real time and are used to locate potential fishing zones (PFZ) that are then made available to the Indian fishing community, which consists of nearly six million fishermen. The Indian National Center for Ocean Information Services (INCOIS) gives the PFZ advisories in local languages, three times a week, to the entire coast of India via fax, phone, Internet, email, newspaper, and radio. These advisories let people know where the fish are likely to be in the next two to four days, and offer detailed directions on how to get there. Using these advisories, fishermen have reduced the time it takes them to find fish by 70 percent and have increased their catch.

"This is a great example of how science can help the common man," continued Jonathan. "But I've thought about this a great deal, and there seem to be some limitations to this system as well. With the current scenario, when the organization receives the information about the PFZ, processes this information, and then sends it out to the general public, by that time the data will already be two days old. Hopefully the fish stay at the same location, but they very well might not. It seems to me that it is so important that the information is delivered in real time and with extremely precise locations."

"And I came up with an idea for how to make it better," said Jonathan, "using Web on-the-go technology. What if every fisherman could carry a Mobile Internet Device? Using that device he could subscribe to the notifications about the fish stocks in the ocean. Once organizations have identified the PFZ, they immediately update their website with that information. They can

even provide the GPS location of those potential fishing zones. All subscribed persons will get an alert and they will head out into the ocean with their MID in hand. Now that they know the GPS location, the MID in fact provides driving directions so the boats can reach their destinations."

"Well, that sounds good for the fishermen today," said Nancy,

"But what about ten years from now? I mean, the real problem is that there aren't enough fish, and this affects people. If we keep allowing people to fish just as hard as they have always been fishing, then the problem will just keep getting worse! What you're talking about seems like a very short-term solution."

"Well, I'm not done yet," said Jonathan, "and I agree with everything you've said. So what they are doing now, is using this exact same technology to find areas where the fish often return over time. While some of these areas will remain open for fishing, some of these zones will be declared 'no-fishing zones' and anyone caught fishing in them will be heavily fined. No-fishing zones will be kind of like preserved habitat areas where humans are no longer allowed. In this way, fish stocks will have safe areas in which they can recover. Officials can use the same method of disseminating information to fishermen, to let them know what zones are off limits. If all fishermen have access to the PFZs, they will also have access to the no-fishing zones, and will have no excuses if they are found fishing in these zones. Indeed, establishing no-fishing zones might be hard for some fishermen in the meantime. But there are other solutions as well, like helping these people to become fish farmers instead of harvesters, or introducing other, easily-farmed meats into the local diet."

"These sure are interesting times," said Jerry.

"Well," said Jerry, "thank you both for letting us in on such important information. I'm so glad that you guys are interested in helping to preserve life on this planet. I have been thinking about another way in which Web on-the-go technology could be really helpful for humans and the Earth. Do you all remember the 2004 tsunami?"

Everyone nodded their heads.

"Amazingly, the earthquake generated by this tsunami is estimated to have released the same amount of energy as 23,000 Hiroshima-type bombs going off at once, at least according to the U.S. Geological Survey."

“Do we have any idea why it happened?” asked Julia

“Well, I’ve read that tremendous forces had been building up deep inside the Earth for hundreds of years. On that day, December 26, 2004, these forces were suddenly released, causing the ground to shake violently. A series of huge killer waves were released and moved across the Indian Ocean as fast as a jet airliner.”

“Yikes,” said Nancy.

“So, National Oceanic and Atmospheric Administration (NOAA) scientists at the Pacific Tsunami Warning Center in Hawaii went to work immediately after they received a seismic signal that an earthquake had occurred. They issued a bulletin to Hawaii, the West Coast of North America, and many other countries that there was no threat of a tsunami to their coastlines. And then they went to work notifying other countries about the potential of a tsunami after the earthquake that had registered as a 9.0.”

“However, the Pacific Tsunami Warning Center did not detect a tsunami in the Indian Ocean, as there were no buoys in place there. They had no idea that they should be contacting the authorities in the Indian Ocean region, and meanwhile the tsunami was traveling at about 500 miles per hour.”

“By the end of that day, more than 150,000 people were dead or missing and millions more were homeless. The devastation ranged across eleven countries, and many considered it the most devastating tsunami in history.”

“So the Pacific Tsunami Warning Center in Hawaii had detected the earthquake, but there was no tsunami alert system in place in the Indian Ocean.”

“Some countries, including Thailand, criticized NOAA, saying they should have done more to raise the alarm. In response to this criticism, NOAA officials said that there was no proper system in place for these countries to receive a tsunami warning. After the tsunami, plans were drawn to expand tsunami detection and warning capabilities.”

“Implementation of this new plan would include enhanced monitoring, detection, warning, and communication of such disasters around the globe.”

“So in response to the disaster, NOAA plans to deploy thirtytwo new deep-ocean assessment and reporting of tsunami (DART) buoys, including areas throughout the Pacific and Caribbean basins. These buoys are able to record surface heights of the ocean via satellites.”

“A tsunami warning system (TWS) is a system meant to detect tsunamis and also to issue warnings to populations in order to prevent loss of lives and property. A TWS includes two equally important components: a network of sensors to detect tsunamis and a communications infrastructure that is capable of delivering rapid alarms so that evacuations can take place. The DART system is a part of this enhanced tsunami warning system.”

“Each DART station consists of a sea floor bottom pressure recording (BPR) package that picks up on pressure changes caused by tsunamis, and a surface buoy. The surface buoy is able to receive information that has been transmitted from the BPR and then transmits data to a satellite. At this point, the satellite retransmits the data to ground stations and the information is immediately disseminated to NOAA’s Tsunami Warning Centers. By using this system, NOAA is able to send warnings to all areas that might be in danger.”

“As the system stands now, the DART station communicates to the NOAA warning centers via satellites. Following this, the scientists process the data manually and then issue warnings,” Nancy concluded.

“Wow, that’s a little bit complicated,” said Julia. “Is there any way to simplify that process?”

“Well,” replied Jerry, “I do think there is a way to implement the Web on-the-go technology in this instance as well, which would simplify things a great deal. Imagine that each DART station had an MID installed. The MID could periodically send the change of pressure data along with the GPS location to the appropriate Websites via the local wireless infrastructure instead of the satellite system. Then, on the Web, the proper software could be available that would process the incoming data and issue warnings to all those who were subscribed to the program. The entire process could be automated and scientists could simply monitor it and act appropriately if there happened to be an exception.”

“Since the satellite link for communication is eliminated, the DART station would be much cheaper and thus it would be possible to install more DART stations in the ocean. Since all data would be collected and stored on the Web, the data would be readily available for further processing and also to retrieve historical data when needed to make predictions about future natural disasters.”

“And because this information is stored on the Web, any authorities around the globe who are interested in these alerts can subscribe to the program.”

“The MID could be used not only for the tsunami warning system; also to monitor and report other natural disasters such as hurricanes, tornadoes, and floods.”

“Wow. That’s quite interesting. Thank you all for sharing such valuable information with me,” said Julia. “All this talk of natural disasters makes me think of global warming. I always wondered why it took such a long time to bring global warming to the attention of the people. I mean, this is an issue that has probably been happening for quite some time. But only recently have people really become concerned about it. If you ask me, this is a huge issue! I think the main reason for this delay is simply due to a lack of information on a real-time basis.”

“Until recently, there was no equipment or system available to monitor the climate changes on Earth. People might have wondered about how their pollution affected the air and climate, but tracking change was virtually impossible.”

“I’m not sure if you all are aware that many countries have what we could call an ‘environmental antennae.’ This antenna is made up of orbiting satellites as well as other sensor equipment, such as the tsunami warning system, meant to monitor specific Earth details. Recently, the world’s countries met with the goal of finalizing plans to link up all of these antennas, and thus form a sort of international fleet of observation equipment.”

“Right now these systems are being used mainly to estimate crop yields, detect earthquakes, forecast droughts, predict floods, and monitor air and water quality.”

“By linking the satellites and sensors together, the sensors will be able to ‘talk to each other,’ allowing information to be shared across continents. This would be a great asset in alerting nations to the threat of looming natural disasters.”

“The nations decided to call this system the Global Earth Observation System of Systems (GEOSS). The program hopes to pool all national and regional observation data within a decade. Once this system is in place, information would be available immediately to each and every subscribing country.”

“But if we instead used the Web on-the-go technology, these sensors wouldn’t need to talk to the orbiting satellite. Instead, they could simply locally access the wireless infrastructure.”

“The sensors could be attached to MIDs. The MID could then send the date and time, GPS information, current temperature on to the appropriate Website. There would be no need for manual data entry.”

“And, as you mentioned, Jerry, Web on-the-go technology is so much cheaper and establishes a system of two-way communication. Right now most satellites have their own unique purpose, like tsunami detector satellites or weather detector satellites. Using Web on-the-go technology, however, the satellite would have a more general purpose. Satellites would provide wireless access so that these other systems are able to function. More than one system could be using one satellite at the same time.”

“Hey,” said Jerry, “I can already envision how efficient that would be. I mean, if we are able to get a thorough picture of what is actually happening on the earth in terms of climate change, natural disasters, ice levels, and so forth, we would be much better positioned to make the right decisions to combat global warming.”

“Exactly,” said Julia, “That’s why it’s such an exciting idea.”

User Stories:

- Kitchen Helper

Application: Kitchen Helper

This document is a collective effort of 31st batch students of Madras Institute of Technology, Chromepet, Anna University, Chennai, Tamil Nadu, India.

Mission: develop innovation and entrepreneurship in student community

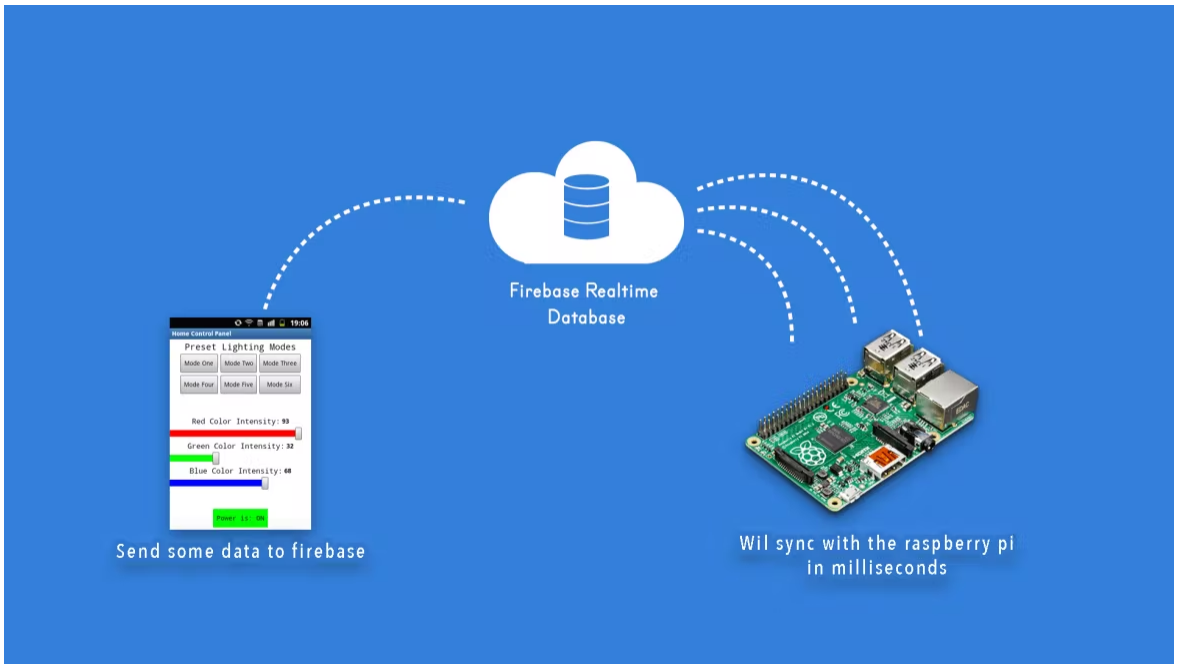
Innovation: Needs have always been there; most of the needs are satisfied; some of the needs are not satisfied yet. Unsatisfied needs are the seeds for innovation.

Entrepreneurship: Innovators create wealth; two Phd students developed Google Search Engine at Stanford; Google still shares revenue with Stanford; We could develop both innovation and entrepreneurship at the university. Students working on an epic could go out and start an industry.

Exploration is **the act of searching an unfamiliar area in order to learn about it**. It involves the discovery of new information; students and gurus gather to explore the sports initiative; both hardcore technical students as well as entrepreneur students participate in the exploration.

Use Case 1

	Both equipment and operator are in Same Building Same Floor Same Room Operator operates the equipment without direct contact. Operator uses the mobile phone. On the phone, turn on the equipment Android => Sends command to Firebase Realtime Datastore from Google Firebase => sends turn on command to the equipment After a while, operator sends turn-off command



Robotic Arm

https://blog.arduino.cc/2022/08/15/real-robot-one-is-a-high-performance-robotic-arm-that-you-can-build-yourself/

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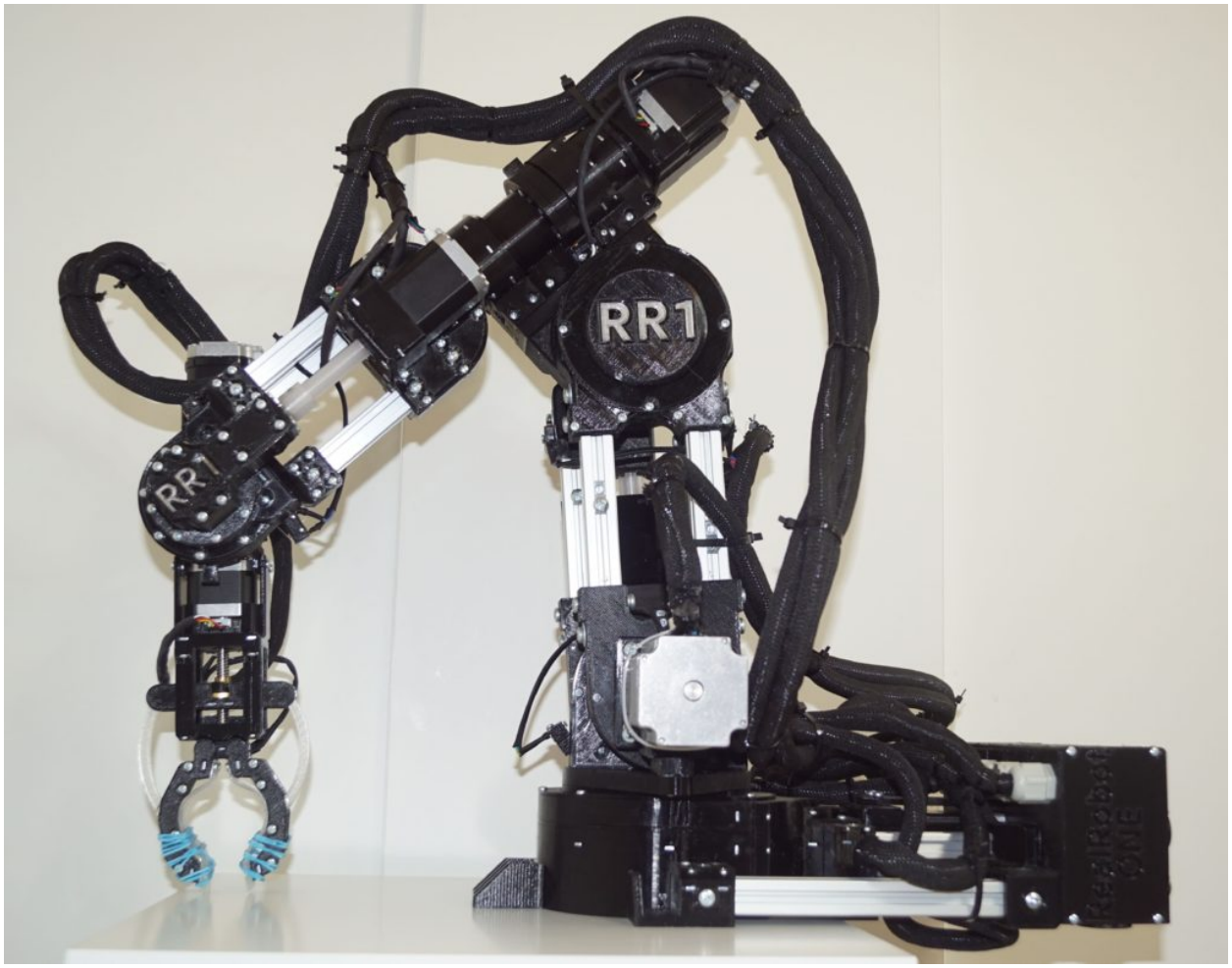

“What are we doing in the Kitchen initiative?”

“Let us start with Wet Grinding.”

“We already have several Wet Grinders from Coimbatore.”

“They are built by men who have never worked in Kitchen. More than grinding, cleaning is the most challenging job with those Coimbatore Wet Grinders.”

“Are we going back to traditional Attukal and Ammikallu?”

“Yes. In the traditional Attukal, the base is stationary; the top one sits inside the pit and grinds within the pit. There is no splashing outside.”

“That’s true; in the Coimbatore Wet Grinder, due to centrifugal force, the batter gets splashed all over the sides.”

“How are we going to collect the batter at the end?”

“We split the Attukal; so it could open and the batter flowed down into a container at the bottom.”

“Who is going to grind urad dal and rice?”

“Instead of a human hand, let us use a robotic arm for all kitchen work.”

“Robotic arm for all kitchen work!”

“Yes. Wet Grinding; Dry Grinding; Onion and Vegetable Cutting.”

“Maybe for dish washing too.”

“Attukal would have one microcontroller; Robotic Arm would have another microcontroller.”

“What would be the commands?”

“Here is the sequence of commands.”

- To Attukal: Wide Open
- To Robotic Arm: Wash the Attukal
- To Attukal: Home Position (both parts join and ready for grinding)
- To Robotic Arm: Wash the urad dal
- To Robotic Arm: Take two cups of urad dal and drop it into Attukal
- To Robotic Arm: Lift the Attukal and start grinding for five minutes
- To Robotic Arm: Stop the grinding and add two tablespoon water
- To Robotic Arm: Home Position (take hands off from Attukal)
- To Attukal: Wide Open slowly
- To Robotic Arm: Push the batter down into the container
- To Robotic Arm: Move the container
- To Robotic Arm: Wash the Attukal
- To Robotic Arm: Dry the Attukal with cloth
- To Robotic Arm: Home Position
- To Attukal: Home Position

“How do we give these commands to the Microcontroller?”

“Through Cloud Computing and Mobile Phones.”

“Even in the same room?”

“Yes.”

“How could we give commands from a different room, without seeing the action?”

“For now, let us use Zoom or Whatsapp video call.”

“Both Zoom and Whatsapp could expand their business to all home and commercial kitchens.”

“When we interface with Meta AI and Metaverse, the Kitchen Helper from a remote location could execute these tasks without issuing one command after another.”

“Who will use these Kitchen Helpers?”

“We live in Chromepet; someone from Yaalpaanam could work on our kitchen.”

“You mean, from Ceylon.”

“Yes.”

“Is it safe?”

“No. it is not; that would be a challenge for security professionals.”

Use Case 2

	Both equipment and operator are in Same Building Different Floor Different Room Operator operates the equipment without direct contact. Operator uses the mobile phone. On the phone, turn on the equipment Android => Sends command to Firebase Realtime Datastore from Google Firebase => sends turn on command to the equipment After a while, operator sends turn-off command
	

Use Case 3

	Both equipment and operator are in Different Building Different Floor Different Room Operator operates the equipment without direct contact. Operator uses the mobile phone. On the phone, turn on the equipment Android => Sends command to Firebase Realtime Datastore from Google Firebase => sends turn on command to the equipment After a while, operator sends turn-off command
	

Use Case 4

	Both equipment and operator are in Different City Equipment is in Chromepet Operator is in Adyar Operator operates the equipment without direct contact. Operator uses the mobile phone. On the phone, turn on the equipment Android => Sends command to Firebase Realtime Datastore from Google Firebase => sends turn on command to the equipment After a while, operator sends turn-off command
	

Use Case 5

	Both equipment and operator are in Different Country Equipment is in Chromepet Operator is in Arizona Operator operates the equipment without direct contact. Operator uses the mobile phone. On the phone, turn on the equipment Android => Sends command to Firebase Realtime Datastore from Google Firebase => sends turn on command to the equipment After a while, operator sends turn-off command
	

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-