International Journal of Agriculture Innovations and Research
Volume 4, Issue 6, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received : 31/05/2016 | Accepted on : 10/06/2016 | Published : 15/06/2016

Conceptual of Mobile Oil Palm Fresh Fruit Bunch Catcher

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***Abstract* – Mobile Bunch Cather (MBC), is an attempt to transform Oil Palm Fresh Fruit Bunch (OPFFB) harvesting concept. MBC main objective is to 'catch' the whole OPFFB right after cutting the bunch. All loose fruits shall be collected simultaneously thus, eliminatory the loose fruit (LF) collection process. A major factor considered during MBC development is the adaption of proven technologies in market into a potential and workable solution of collecting together the FFB and LF. In this concept, a forklift working principal and a Backhoe outrigger working principal is integrated into one piece of machine, the MBC. This machine not only able to lift up and down the catchment head, but also ensures the stability in various ground topography. MBC will ensured the quality of LF in 100% good condition in oil extraction rate (OER). MBC also promised a FFB processing without a trash such as stone, soil, debris and anything which effect a hygiene quality in milling process. From fact, A high quality of crude palm oil will produced as premium oil. At side of milling FFB, a lot of energy and labour will be saved because no trash/dirt process with FFB and FFB processed in optimum energy used.**

***Keywords* – Mobile Bunch Catcher, Oil Palm, Fresh Fruit Bunch and Loose Fruit.**

I. INTRODUCTION

Every day, harvesting FFB will increase burden to oil palm plantation management. Due to lack of workers and equipment in suitable with the palm condition, indirectly harvesting requires a mechanism that can facilitate this activity. One of the main problems in activity harvesting is collecting a loose fruit. Abdul Razak (1998) claimed the loose fruit that's found at base of oil palm constitute about 3% -5% of the bunch weight [1]. Total loose fruits that many will delay the harvesting activity. The current activity, fruit loose collections are manually by hand picking or racking. Kamarudzaman, A (1994) stated that's high percentage of debris collected in loose fruits using raking method has been reduced to acceptable levels because quality of loose fruit which collected [2] . Conventional harvesting process using pole and sickle to cut ripe FFB. When FFB falling down to ground, loose fruit scatted around palm base because an impact and FFB ripeness.

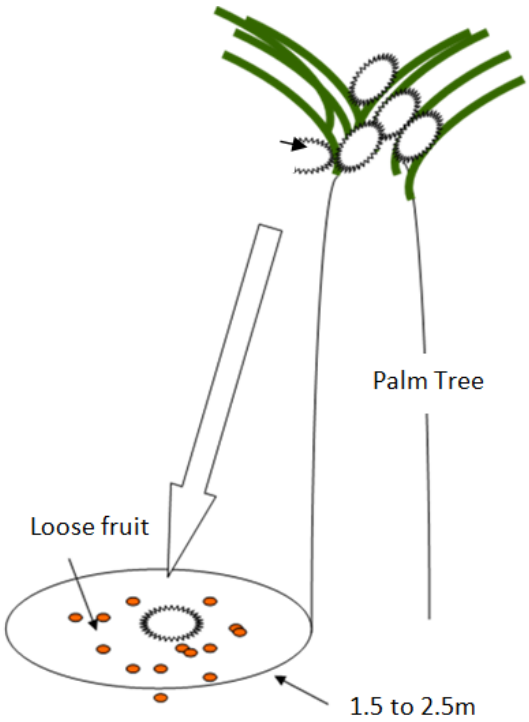

Fig. 1. Fresh Fruit Bunch Falling to ground

Figure 1 above shows the sketch drawing of loose fruit spreader when harvesting FFB. Loose fruit will be scatted around 1.5m to 2.5m. Loose fruit will collected using racking, scrapper and net. Below show conventional equipment use to collect loose fruit.


Fig. 2. Equipment to collect loose fruit

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Azali 2013 [3] also showed a trash contain in every collection of loose fruit. Below in figure 3 a trash contain with loose fruit. Trash contain stone, debris, soil and another 'matter' which will lowed a quality of crude palm oil.

Fig. 3. Trash contain in loose fruits consumption

II. Material and Method

Mobile Bunch Cather, MBC is specifically designed to eliminate the loose fruit collection process. To recover some of the lost, secondary process is carried out to collect the loose fruits from ground. By then the loose fruits may contaminated with ground soil and debris. This complicates the cleaning process at mill. There are several key objectives that MBC shall produce:

1. To evacuate fresh fruit bunch effectively, fresh and free from contamination.
2. To minimize yield lost due to Loose Fruits (LF). LF loss is expected to be reduced to a minimum as 2 % during the harvesting process.
3. To eliminate secondary process of collecting Loose Fruits. Manual collection by human may not be necessary and can be eliminated.
4. To eliminate cleaning and separation process between LF and impurities. Separation and cleaning which normally done by machine is no longer necessary.

The foundations created at the concept development stage of a design project are fundamental to its success; it is where we work out what works, what doesn't and what's possible [4], Moreover development of system, tool or design also indirectly helps the end users in acquiring a better and faster production [5]. Recent development in the mechanization of harvesting of agricultural products have brought about Concept design and concept development of MBC will also include basic computer aided design (CAD) to allow us to fully visualize and more importantly to develop real machine operating at plantation. MBC is initiated about a year ago. Aim of this design is to solve loose fruit collection which loose fruit contribute high OER in palm oil plantation.

From that statement, a special catchment head was designed and proposed. The harvested FFB and LF will drop into the catchment head and then rolling down inside channel into attached trailer. The prototype nicknamed 'Casuari' was tested several times at Felda Plantation. The result is promising and it motivates the team to works further. With continue improvements on some debated ideas the team confident to move forward with MBC prototyping build. Below in figure 4 shows first design of 'Casuari' machine and figure 5 shows the design of casuari.

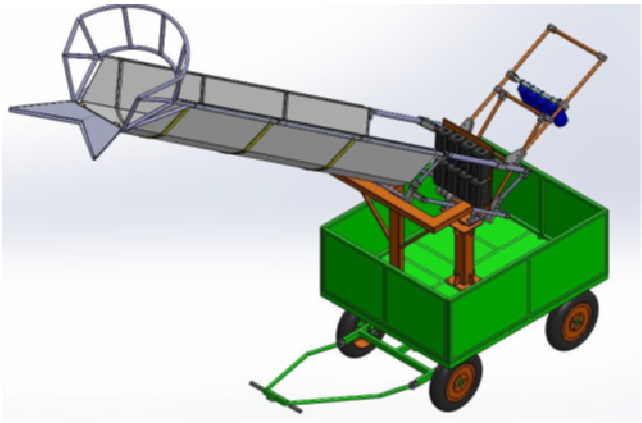
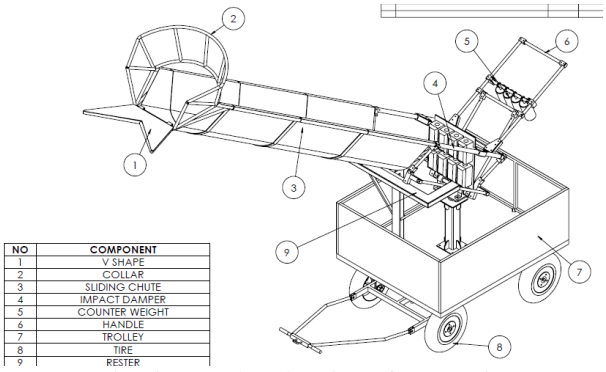


Fig. 4. Casuari first prototype



NO	COMPONENT
1	V SHAPE
2	COLLAR
3	SLIDING CHUTE
4	IMPACT DAMPER
5	COUNTER WEIGHT
6	HANDLE
7	TROLLEY
8	TIRE
9	RESTER

Fig. 5. Snapshot drawing of 'Casuari'

The concept of MBC is derived from a proven work of Forklift. Hydraulic system is a prime working tool to perform harvesting task. MBC is powered by diesel engine and a front wheel drive machine to ensure maximum traction. The load is located upfront. Except unlike the forklift, MBC is built with outrigger to increase machine stability during harvesting.

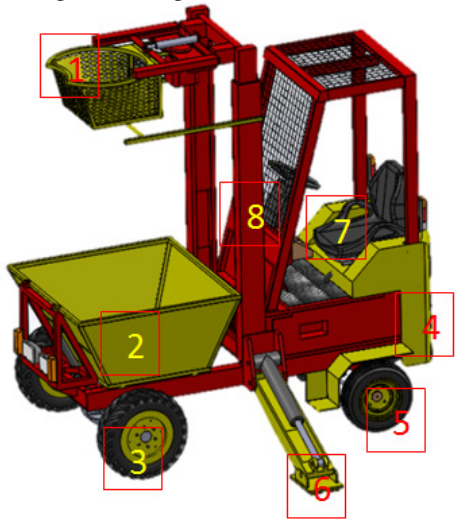


Fig. 6. Mobile Bunch Cather 3D drawing

International Journal of Agriculture Innovations and Research
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Mobile Bunch Catcher consists of 8 major components with following functions:

Components	Function
1. Catcher	A head device where the harvested FFB drop and withheld temporary before being lifting down and release into collecting bucket
2. Bucket	A fully covered enclosure to contain FFBs and loose fruits
3. Front tire (tracking)	Front wheels driven ensure an optimum forward tracking in variance topography
4. Engine compartment	The compartment consists of 2 major mechanisms, An engine is to drive the MBC as well as driving the hydraulic pump
5. Rear tire with steering	Maximizing maneuver in tight space around trunk and between trunks. Ensuring minimum turning radius
6. Out trigger	A safety mechanism consisting of lift and right and to stabilize the mobile bunch catcher. The outriggers are engaged once to MBC is park and before harvesting process starting.
7. Driver compartment	A control compartment to operate to hydraulic system and mobility of MBC
8. Lifter	A lifting mechanism to lift the catcher up and down.

Table 1. MBC main components and functions

III. MBC Features

i. MBC consists of prime mover, machine stabilizer, FFB catcher and bucket in one machine.
ii. The MBC catcher lifter working height of 5 meters.
iii. The MBC catcher load capacity is 100kg.
iv. MBC is capable to operate effectively in flat and mild undulating topography.
v. Harvester view and accessibility is not obstruct by MBC or its components
vi. MBC bucket is capable of handling maximum load of 500kg.
vii. MBC bucket is capable to unload FFB into collecting Bin,
viii. MBC works within acceptable noise level.

IV. Result and Discussion

From result, a process flow design diagram to construct MBC prototype. Diagram shows as below describe a motion study of MBC prototype. This is important study to design MBC prototype because harvesting need a step of motion parallel with software design. Abdul Razak Jelani [6] was studied design of harvesting tool from using manual harvesting tool to motorized cutter based on movement of harvester, specification of cutting edge and production of fresh fruit bunch. From study also shows a new development of CANTAS was developed and improved production of fresh fruit bunch. Process flow diagram in figure 7 show a motion of MBC begin from start until FFB unload to platform or BIN. This sequence important to guide design of prototype can achieve target of this project.

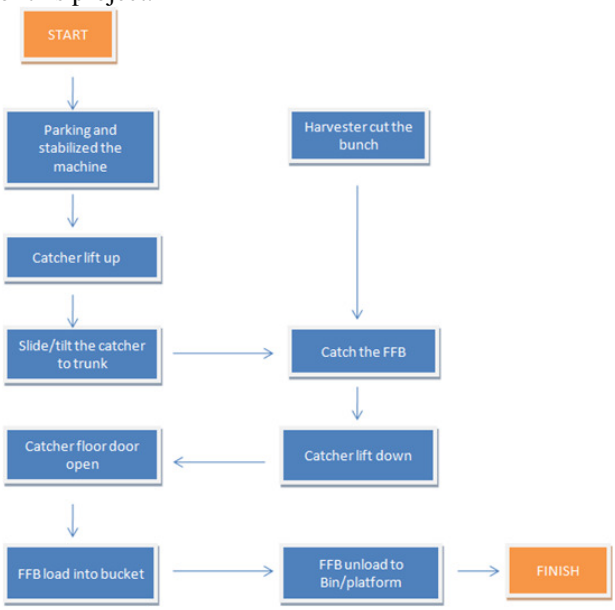
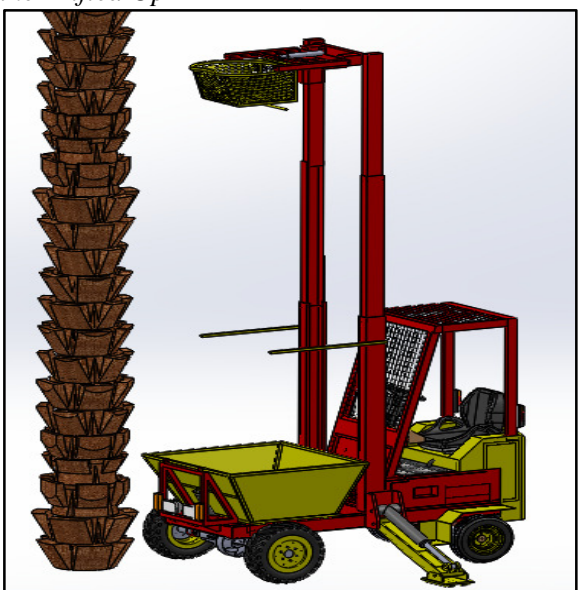


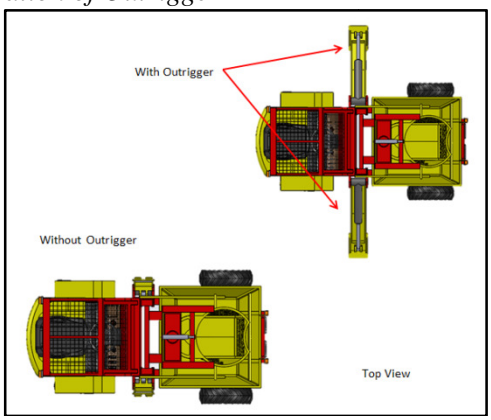
Fig. 7. Process Flow Diagram of MBC motion study

V. Process Flow Illustrations

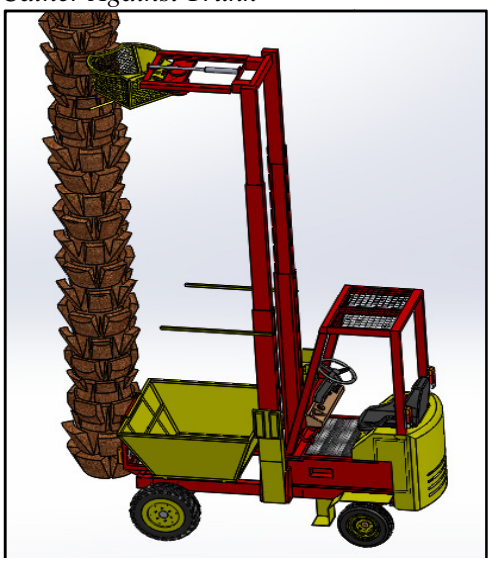
Cather Lifted Up



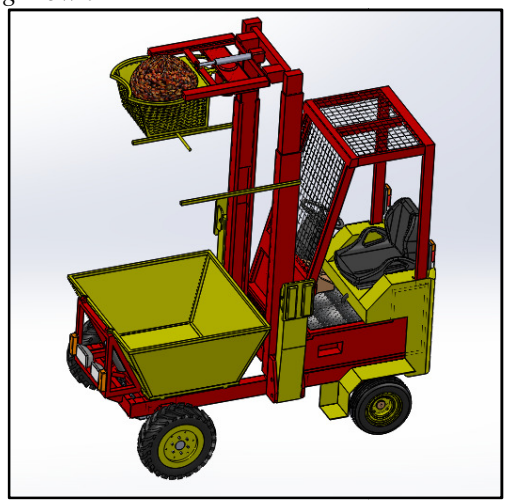
Application of Outrigger



Tilted Cather Against Trunk

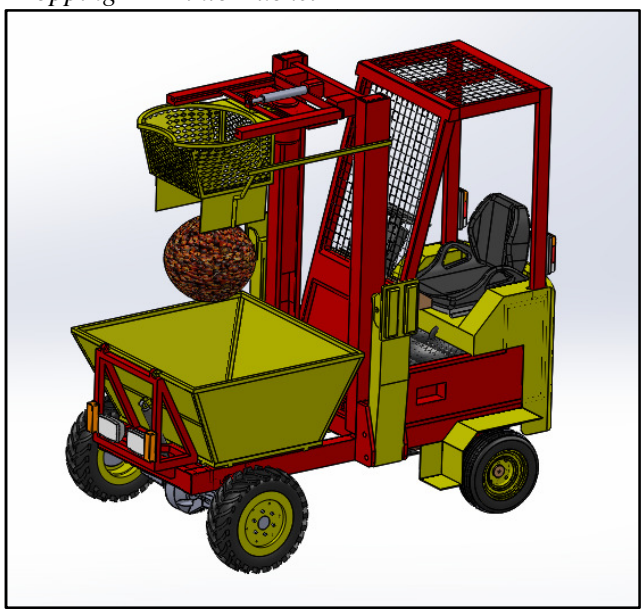


Lifting Down FFB

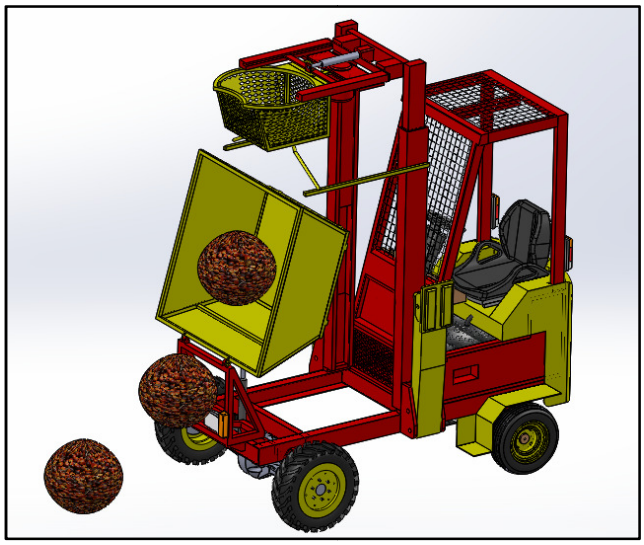


The figure above shows the prototype MBC illustration. Figure A shows the prototype in the park using the MBC mechanism called outrigger. Outrigger serves stabilize machinery for use in areas that are not flat. After stabilization, a catcher will be raised to be placed next to the tree trunk. Figure B and Figure C shows the movement. Catcher will be placed next to the palm trunk for the right angle and right after cutting a bunch done. Figure D shows the catcher down the FFB that has been cut. A special design of catcher allow FFB unload to container. Figure E shows a door at catcher allow FFB load to container. Control by spring trigger, a door open using load of weight of FFB.

Dropping FFB into Bucket



Unload FFB



VI. Conclusion

There are lot of handful challenges and risks that may posed towards MBC completion, implementation and plant wide practice. MBC does not present new or advance technology. MBC adapting technology that is proven and readily available in market. It may not pose a difficult task to maintain MBC and make MBC as a productive plantation machine. Maintenance team will be able to go through learning curve in a very short time and be independent fast. Extension of application from the MBC current design is promising. Current design limits Cather

working height to 5 meters. With some understanding on how MBC perform on various harvesting constrains, knowledge gains from MBC implementation and some engineering work, MBC has a potential to be further developed to higher Cather working height of up to 15 meters. Management of plantation may have reservation on MBC unless MBC could outperform current harvesting method in termed of harvested number of FFB per day. MBC has to demonstrate this capability in matching the run rate.

While that may prove a tall order, MBC offers other benefits where the current harvesting method may not able to achieve though, such as:

i. Economy value gain due to effective recovery of quantity of LF collection.
ii. Economy value gain due to EOR improvement from effective LF captured by MBC.
iii. Reduction in harvesting cost due to reduction or elimination of LF collection, separation and cleaning process.
iv. Improvement of FFB cleanliness quality as the FFB and LF are not drop or touch on ground.

VII. ACKNOWLEDGMENT

The authors wish to express their thanks to Felda Agricultural Services Sdn Bhd and FGV Research and Development with whose support much of this work was performed under a project entitled “Mobile Bunch Catcher”. The authors wish to thank Senior General Manager and Chief Executive Officer of Felda Agricultural Services Sdn Bhd for permission to publish this paper.

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